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COLLECTIVE REVIEW

VENOUS OBSTRUCTION IN THE UPPER EXTREMITY (PAGET-SCHROETTER'S SYNDROME)

A Review of 320 Cases

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IN 1875 a series of lectures that had been delivered by Sir James Paget was published; in the course of one of these, entitled "Gouty Phlebitis," he described 2 cases in which the clinical features, he believed, were attributable to a thrombosis of the main veins of the upper extremity (151).

A man about 50 years old, thin and moderately muscular, and usually healthy, observed, during a September, that his right arm was growing larger, and, as he thought, stronger, and fitter for work. But, as it still increased, it became inconveniently heavy, and certainly weaker; and then he applied for advice. I found the upper arm two inches more in circumference than the left, and the whole limb enlarged in the same proportion. It looked full, round, and muscular, and felt firm, and oedematous, not only in the subcutaneous tissue but throughout; the skin was tense, cool, and pale. In nearly four inches of its course the axillary vein felt large, hard, and cord-like; and in one or two spots over it pressure caused pain; but with this exception no pain was felt in any part of the arm. Some of the superficial veins in the arm, and over the upper and front part of the chest were enlarged, and when the arm hung down for a long time the hand became dusky. No cause whatever could be traced for this condition; no injury or pressure; no known inheritance of disease; no disturbance of the general health, past or present.

With the help of hot douche, warmth, and friction the swelling of the arm very gradually subsided; and, as it did so, the cord-like feeling of the obliterated axillary vein became more distinct. A year elapsed before the vein regained its completely natural condition; but it has now for more than five years been well.

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Very similar to this case was that of a regimental servant, 27 years old, previously healthy, and very active, who was sent to me on April 25th, 1855 by Mr. Bossey, on account of the condition of his right arm. This was swollen, and when it hung down, he had a feeling of weight and fulness as if the blood could not return from it. The arm was, indeed, about a quarter or a third larger than the other; but its chief enlargement felt as if due to great muscular development. Besides this, however, it had probably some general swelling, which might be from slight oedema of its deeper tissues; its subcutaneous veins were all overfull; there were small bluish spots over the deltoid, as if from small clusters of varicose veins, and the veins over the right pectoral muscles were fuller than those over the left. This condition of fulness extended as high as the deltoid's origins: the shoulder especially was remarkably broad and large, and there were fulness and some prominence of the upper part of the right great pectoral. The heart's action and sounds were natural; so was the pulse at both wrists, equal and moderately full. It was uncertain how long this state of the arm existed; it had been observed only a week; its rate of increase was unknown. The patient remained in about the same condition till May 4th, when he was taken into Hospital, and ordered milk diet; six leeches every third night; and three grains of Mercury with chalk every night and morning. He was under this plan for about a fortnight, and certainly improved, the arm decreasing, and its veins becoming less full. Then he had an attack of scarlatina, and while this was running its course all signs of the affection of the arm disappeared. It regained its natural size; the veins were scarcely fuller than in a healthy man; he lost the sensation of numbness, and he believed himself well at the end of May.

In 1884, von Schroetter reported a similar happening in the right arm of a healthy painter who was working at the time of the onset. Schroetter believed that the axillary vein was damaged and

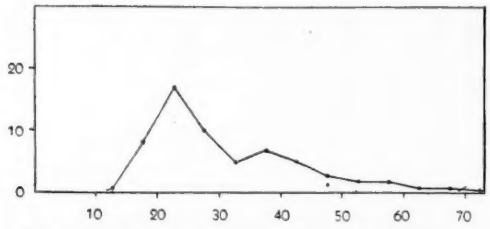

Fig. 1. Age of patients in years. The graph rises abruptly to its highest level between 20 and 25 years. The incidence gradually declines and relatively few cases are seen after the age of 50 years.

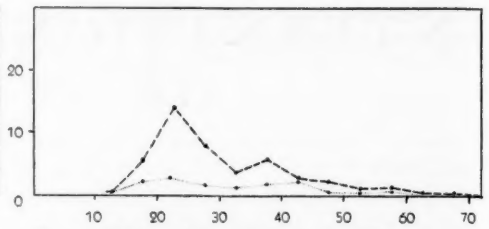

Fig. 2. Relation of age in years to sex. Males—— Females..... There is no significant difference in the ages at which the two sexes are affected.

was subsequently obstructed by a thrombus. Damaschino is said to have studied a similar case 3 years later. These cases are to be distinguished from the one described in 1894 by Letulle and Meslay in which thrombosis of the subclavian and internal jugular veins complicated extensive carcinoma, and from those reported by Bouchut, Humphry, Meslay, and others in which thrombosis of the subclavian and axillary veins occurred in the terminal stages of advanced cardiac failure.

No further cases of the type described by Paget and Schroetter appeared in the literature until 1910 and 1911 when Schepelmann (189, 190) published his observations on a boy of 22 years who developed pain and swelling in the left arm following overexertion controlling high spirited horses. Ruge and Unger both gave an account of cases in Germany in 1911, and at the Fortieth Congress of Surgeons in Berlin in the same year Heinecke reported 3 cases while Rosenthal added 2 more the following year. German authors continued to show considerable interest in the syndrome; further examples were published by Baum, Hollander, and Finkelstein; Loehr reviewed the literature in 1929 and added 6 more cases (124); and more recently, several large series have been reported (82, 125, 212, 222).

In France, Layrel described a case in 1911, and in 1913 there was considerable discussion on a number of patients presented at the Paris Surgical Society (22, 45, 141, 164, 174, 181, 193). Further cases soon followed and by 1932 Cottalorda was able to publish a long review, but relatively few have since been reported in the French literature.

In 1913 Gautier reported 2 cases in Switzerland and he quoted a thesis written a year earlier on the subject by a compatriot, Madame Bogdanoff. Winterstein added 4 more cases in 1925, reviewing the literature at the same time. Vossenaar described a case in Holland in 1913 and Goudsmit reported another some years later. In Scandinavia, the first cases were published in 1929 and 1932 by a Dane, Thomsen (202, 203), while Ljunggren, from Sweden, reported a third in 1936. Excellent reviews have recently been published by Roelsen of Denmark (177, 178).

Professor Ranzi, of Pisa (1849), has been accredited as the first to suggest "effort" as a cause of thrombosis (161, 204). Carere discussed the condition in 1911, and several comprehensive reviews have been written by his Italian colleagues, Pinelli, Paggi (153), Piccagli, Tomasi, and Pozzi.

The first cases to be reported from South America were those of Chutro, of Argentina, in 1914 and 1915 (32, 33). In 1920 Pavlovsky gave an account of 3 cases, and 3 more were reported by Ivanissevitch (94) 2 years later. In North America, Wilson described 2 cases in 1922, while Lowenstein, in 1924, made the first real attempt to find the solution to the problem of etiology. In recent years the condition has aroused much interest in the United States.

Willan discussed the cases of 3 patients in 1918, and 10 years later Gould and Patey (70) reported 8 more in London and described some original work on the subject. However, the syndrome has never excited much attention in Great Britain and relatively few cases have been described.

TERMINOLOGY

The uncertainty which surrounds the etiology and even the pathology of this condition is reflected in the varied terminology. Most authors have used the terms "thrombosis" or "primary thrombosis" of the axillary (subclavian) vein. Those who are impressed by the possible etiological significance of injury to the vein, have termed the lesion "traumatic," "strain," or "effort" thrombosis, while others have preferred to add the prefix "so-called," for example "so-called traumatic thrombosis."

Loehr (125) has suggested that the term "intermittent venous claudication" is as apt as any

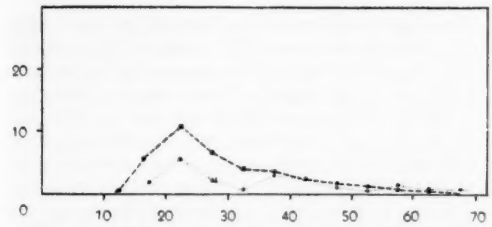

Fig. 3. Relation of the age in years to the side affected. Right—— Left..... There is no significant difference between the ages at which the two sides are affected.

other and this has been supported by other German writers. But Hauge believes it to be inaccurate because recurrence of symptoms after exercise is more probably due to inability of the collateral circulation to deal with the increased volume of blood rather than to any intermittent obstruction; he suggests that the condition be termed "venous stasis." MacCarthy has described his case as "traumatic venospasm," and there is no doubt that this was a feature of his case; but this has been unproved in the majority of cases, and does not appear to be the underlying factor in any case. "Acute (subacute) oedema of the arm" is a most unsatisfactory term.

The association of a more or less acute venous obstruction in the upper extremity of an otherwise perfectly healthy person constitutes a syndrome which, in the absence of accurate knowledge of the etiology and pathology, can be called the "Paget-Schroetter syndrome," after the first two to describe it as a clinical entity.

CLINICAL FEATURES

Age. Buxton stated that he had seen the condition in a patient of 75 years of age but gave no other details. Gautier reported it in a man of 72 years; this patient appears to have been perfectly healthy, although he had a positive Wassermann reaction. Moure's case (142) was that of a woman of 71 years who developed a subclavian thrombosis after sustaining a fractured clavicle which gave rise to a fatal embolism 4 days after the injury. It is doubtful if either of these last 2 cases can be rightfully included in the disease under discussion. Salmon and Audier reported a patient of 70 years, Lenormant and Mondor one of 68 years, while Stover and Herrell, and De Bakey, Ochsner, and Smith have had instances in people of 66 years. On the other hand, the youngest patient so far observed has been a girl of 11 years, observed by Rosenthal, in whom the onset followed a very light game with a ball. Lapeyre has seen a boy of 14 years affected after carrying a heavy bucket of water. The onset has been noted, on occasions, in children of 15 years (43, 209) and 16 years (43, 159), while several authors have had 17 year old patients (92, 132, 150, 154, 155, 158, 164, 178, 201, 220) (Fig. 1).

Fig. 4.

Fig. 5.

Fig. 4. Sex. Males are affected in 78 per cent of the cases; females in 22 per cent.

Fig. 5. Side. The right side is affected in 66 per cent of the cases; the left in 34 per cent.

Sex. The predominance of the male sex has been recorded by all reviewers. All 3 of Willan's patients were males as were the 3 patients in the cases published by Heinecke and Pavlovsky (155). Kinzel, Loehr (125), Kux, Kaplan (101), and Morton each reported 4 cases, in all of which the patients were males, as were all 8 in the cases reported by Gould and Patey (70). Seven of the 8 patients in Zehnder's series, 6 of the 7 in Herlyn's, and 5 of the 6 in Barker's were males, and there was only 1 female in each of the series of 5 reported by Wagner and Sampson (184).

On the other hand, 5 of the 7 patients in the cases published by Roelsen in 1939 were females (177), and 3 of the 7 patients seen by the same author in 1944 were also females (178). Three of the series of 5 cases published by both De Bakey, Ochsner and Smith, and Hughes were those of females, as were half of those reported by Loehr (124) and Hunter. Both of Clute's and both of Goudsmit's patients were females. The relative incidence of males and females is shown in Figures 2 and 4.

Side. The right arm is involved more frequently than the left (66%). This was conclusively demonstrated in Paggi's review in 1933 (153) and, apart from a few exceptions (25, 53, 78, 80, 124,

125, 133, 145), is further exemplified in the individual series that have been published. As a result of this right-sided predominance, it has been suggested (209), although incorrectly, that whenever the left arm is affected the patient is left handed or has used the left arm in some unusual manner. For example, Schepelmann's patient is said to have used his left arm to control the horses; and Winterstein who had 2 such instances in his series pointed out that 1 occurred in a weaver whose work involved extra strain on his left arm, and the other occurred in a man engaged in lifting heavy bales of cloth who used his left arm more than his right. The relative frequency with which the two sides are affected is demonstrated in Figures 3 and 5.

Onset. The clinical features are characteristic when the condition has fully developed, but the initial symptom and mode of onset show some variation.

1. The arm becomes swollen in 57 per cent of the cases, sometimes slowly, but more often rapidly and occasionally quite suddenly. This is accompanied by a sensation of tightness and of fullness and the limb feels heavy and stiff.

2. In 34 per cent of the cases the first symptom might be spontaneous pain in the arm or shoulder or it may be perceived only on movement; there is sometimes a sensation of undue fatigue in the arm.

3. In 6 per cent of the cases there is discoloration, or prominence of the veins in the arm or on the chest wall.

4. Two per cent of the patients on performing a movement have suddenly experienced a peculiar sensation in the shoulder or arm as if something had given way or "snapped" (114, 128, 150, 171, 211).

5. Two patients experienced *paresthesia*, a tingling sensation in the arm, immediately prior to the development of the typical clinical features (50, 114).

6. In 1 of Roelsen's cases the first symptom was pruritus in the affected arm (178).

7. Routier's patient complained of a sudden onset of "paralysis" of the left arm, while Barker, Kux, and Unger have noted weakness as an initial symptom.

In some cases the onset is acute and in others quite gradual; a sudden onset may occur in patients unexposed to any provocative activity, while a gradual development occurs after an apparently definite causal trauma. Whether the onset be sudden or gradual, the first symptom may be either pain or swelling. Veal and Hussey (207) believed that a gradual onset was nearly always due to malignancy with initial symptoms of slight enlargement of the arm and unusual fatiguability. This appears to be an oversimplification because in many of the cases reviewed the condition developed insidiously without any evidence of malignancy at all. Moreover, many patients noticed aches or pains in the shoulder or arm for some days prior to the appearance of the swelling and discoloration. Nor can one agree with Goldberg and Foley and others who believe that it is atypical for the onset to be gradual and unaccompanied by pain.

In 39 instances (13% of the number in which the onset is described) the patient awoke to find that the arm was swollen or blue, or ached or felt heavy.

Swelling. This has been noted in every case but 2 (40, 195), and it is doubtful whether these 2 cases should really be considered as examples of the condition. In some cases the swelling only becomes apparent after the performance of some form of exercise. The whole arm is affected, from finger tips to shoulder, and usually the swelling spreads on to the chest wall and may extend into the neck (136). Even in cases in which the swelling is considerable, pitting with the thumb is frequently impossible, because of its firm nature. It might begin quite insidiously and even remain unnoticed by the patient until pointed out by another, or until the sleeve of a garment or a ring can no longer be worn. In Paget's first case the patient observed that "his right arm was growing larger and," as he thought, "stronger, and fitter for work." On the other hand, as Matas, and De Bakey, Ochsner, and Smith (43) have emphasized, an occasional feature of the syndrome is the rapidity with which the swelling spreads over the arm.

Extreme distention of the veins must largely account for this swelling; such venous overfilling is easily demonstrated by the distended appearance of the superficial veins, by their failure to collapse on elevation, and by the marked rise of the venous pressure. Excessive interstitial fluid plays a less important role, although it may be the chief factor; for example, in some cases the swelling is soft and compressible and some surgeons have noted a considerable drainage of fluid from incisions in the arm.

Pain. This is a variable symptom and may never be present (67, 72, 178, 207, 215). The swelling frequently causes a dull ache in the arm, which is usually mild but may be severe; such "tension" pain is diffusely referred over the whole of the arm. In some cases, pain is localized to the region of the shoulder girdle, particularly the

axilla (118, 177); in these circumstances it probably originates from the primary lesion itself, whether it be complicated by a thrombus or not. When a thrombus exists and propagates itself along the brachial vein, it may be followed by pain referred to the medial side of the arm (215). Sometimes the patient experiences pain, often intense, only after exercise of the arm, this being presumably due, partly, to a retention of metabolites and, in part also, to the swelling that the exercise provokes. The second case reported by O'Regan was unusual in that the pain was situated high up on the right side of the chest and was aggravated by deep breathing; this was shortly followed by the appearance of the signs of venous obstruction in the right arm.

Discoloration. The arm develops a cyanotic hue, although occasionally it becomes red or pink (64, 84, 101, 178) and may even become white (189). This discoloration, which is nearly always to be observed at some time during the illness, is usually diffuse, but may be mottled (63, 131, 158). Roelsen (177) noted in one of his cases that even before the onset of the disease the hands became blue and black in cold weather. Bruising of the skin has been observed and Roelsen (178) described the appearance of "phlebactasis."

Venous distention. Almost without exception the disturbance in the circulation has been reflected in the superficial venous system. These veins become engorged, and previously unnoticed veins about the shoulder and neck become apparent as the circulation develops through collateral channels. These distended collateral vessels may be the first evidence of the disease (37, 70, 177, 178), and are usually apparent at the initial examination, although excessive subcutaneous tissue or considerable swelling may obscure them at first. Sampson, Saunders, and Capp (185) have reviewed the anatomy of the superficial veins of the thorax which are involved. There is a group of veins which stretches between the cephalic (and sometimes the basilic) and the external jugular veins, passing across the clavicle and upper part of the chest. A second group passes inferiorly over the thorax and connects the axillary or basilic veins with those of the abdominal wall, including the musculophrenic venae comitantes. This connecting channel is constituted by the lateral thoracic vein, external mammary vein, mammary subareolar plexus, and epigastric veins. This second group anastomoses with the first and also with the venae comites of the internal mammary artery of both sides.

Paresthesia. The pins and needles sensation and tingling have been experienced by a few patients but there is no particular distribution. One of Roelsen's patients complained of paresthesia in the hand (177); Ffrench's patient noticed tingling in the finger tips, while one of Willan's patients referred the sensation to the palm and thumb when the arm was held in certain positions. A patient observed by Rixford experienced tingling in the arm immediately after the onset and another, numbness in the hand at night, while Roelsen's second patient in his 1944 series only experienced the sensation after the venography wound in the cubital fossa had suppurated (178). Horton's patient developed tingling in the arm after lying on it; another of Roelsen's patients felt pins and needles in the arm when it was dependent (177).

Pruritus. Roelsen (178) reported the case of a man of 35 years who rubbed his right arm to relieve a persistent itchy sensation; within a very short time the arm was found to be diffusely swollen and discolored, with distention of the superficial vessels.

Movements. Wilson described complete paralysis of the muscles in the affected arm in both his cases and attributed it to pressure on the brachial plexus by a thrombus. Others have found varying degrees of temporary paralysis (22, 26, 77, 122, 129, 134, 143, 144, 160, 164, 181), but such observations lose much of their significance without uniform expression of muscle power.

The passive movements of the limb are generally unrestricted but there may be some limitation as the result of pain and swelling.

Palpation. Many authors have found abnormal conditions on palpation of the axilla, and it seems certain that a thrombosed vein is sometimes, if not frequently, the responsible factor. Gould and Patey (70) noted that the axillary vein felt like a cord from its commencement to the clavicle. Gerster found a "cord-like structure, very firm, fixed, immovable mass, 2.5 cms. in diameter which could be followed for about 6 cms." Hauge described the axillary vein as "feeling like a cord, thick as a pencil and increasing to more than the thickness of the finger at the upper part of the shoulder; insensitive". Ivanissevitch, McGoogan and Simmons and Kaplan (101) palpated hard tender cords in the axilla which could be traced down the arm to the midforearm, and occupied the track of the brachial, basilic, and median basilic veins. Although most writers have described a "cordlike thickening" in the axilla, both Guyott and Jeanneney and O'Regan found localized mobile tumors of small size and tender on pressure; it is possible that these were thrombi as believed by the authors. On the other hand, Cottalorda found no thrombus at operation on one of his patients

despite the fact that it was regarded as certain that such could be detected clinically. Roelsen (178), after careful investigation of his patients, evidently felt that it was a difficult matter to decide whether the vein was thrombosed or whether it was merely distended with fluid blood.

In some cases the axilla has been tender without the presence of any palpable lump (23, 70, 173, 184, 215), while Ffrench and Rixford have noted a delayed appearance of a cordlike thickening along the brachial vessels. Others have not been able to demonstrate any cord, tumor, or tenderness, although the other clinical findings are in every way similar to those in cases which possess positive signs (3, 64, 86, 94, 101, 103, 128, 131, 138, 141, 158, 177, 183, 184, 186, 200, 215).

In a few cases there has been tenderness, and sometimes a lump in the supraclavicular fossa suggestive of thrombosis of the subclavian vein. In Lenormant and Mondor's case the external jugular vein appeared to be thrombosed (118), and Ditter and Walker describe a "cordlike induration with a zone of slight redness but non-tender along the course of the cephalic vein".

Venous pressure. Increased venous tension exists in all cases, and on examination this is obvious from the engorged veins of the arm. Veal and Hussey (207) described a technique for measuring venous pressure accurately both in a state of rest and after exercise of the arm; this constitutes their "exercise test." Hauge also utilized the abnormal rise of venous pressure on exercise in his "provocative test"; he estimated the venous hypertension clinically.

The normal venous pressure varies from 5 to 12 cm. of water. In this syndrome, a very high venous pressure has been observed in the resting arm on several occasions. Kaplan (102) had 2 cases with a resting tension of 21 and 41 cm., respectively. Salmon and Audier, Greenfield, and Roca and Lazaroni have also noted marked increases at rest.

In some cases the resting venous pressure has been only slightly elevated, but an exaggerated rise follows exercise. In Roelsen's 1939 series (177), one patient had a resting venous tension of 9 cm. on the affected side, a rise of 4 cm. above that on the normal side, but this difference increased to 21 cm. on exercise. A similar case was recorded by the same author in 1944 (178), and Willcutts and Shelburne reported a case in which the patient presented a difference of 3 cm. between the arms at rest, but after exercise the normal side rose to 9 and the abnormal to 37 cm.

Although this accurate estimation of the venous pressure is of considerable interest, the procedure is for the most part unnecessary and should be reserved for the occasional case in which the diagnosis might be in doubt.

Collapse of the veins on elevation of the arm. Several authors have noted that the superficial veins empty slowly on elevation of the arm (48, 101, 102, 150, 184). Keener, Canty, and Prevost, and MacCarthy found that they may fail to empty at all, while Kaplan (102) observed in one of his patients that some of the veins emptied but others remained distended.

Circulation time. The circulation time from the affected arm has been investigated by several observers. Calcium gluconate in a 10 per cent solution has usually been employed for this purpose. As might be anticipated, in every case investigated, the circulation time has been prolonged (37, 48, 72, 101, 102, 158, 207, 216).

Oxygen saturation of the venous blood. Veal and Hussey (207) found a lowered oxygen content of the venous blood in their patients, and this has been confirmed in other cases (72, 86).

Cruickshank regarded the test of such importance that although there was neither swelling nor discoloration in his case, he believed that a diagnosis of axillary vein obstruction was justified because the oxygen saturation of the venous blood was only 43 per cent as compared with a normal of 70 per cent on the opposite side.

Skin absorption time. Salmon and Audier, and Willcutts and Shelburne injected 0.1 c.c. of normal saline solution intradermally and noted its disappearance in 50 seconds from both the normal and the affected arms. They are the only investigators to record such a test in this condition.

These last three investigations, like the measurements of venous pressure, are of undoubted value in a case in which the diagnosis might be obscure. However, as this is rarely the case their practical application is limited.

Arterial pressure. There is no clear agreement as to the state of the arterial tension in the affected arm. Bazy, Kaplan (102), Greenfield, and MacCarthy have noticed the radial pulse to be weaker, but most observers have been unable to detect any difference. The blood pressure in the involved arm also shows no appreciable departure from the normal level in most cases. In one of Sampson's cases (184) the blood pressure was found to be the same in both arms, but in another the pressure on the affected side was 100/70 mm. of mercury while on the normal side it was 135/70 mm. of mercury; six days later there was still a depression although the pressure was approaching normal. Other au-

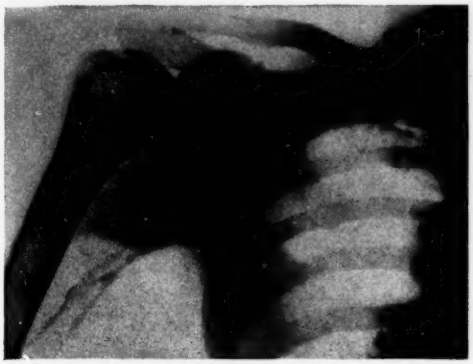

Fig. 6. Normal venogram. The basilic, brachial, axillary, and cephalic veins are well filled but the subclavian vein is not visualized. The veins show localized dilatations above the valves. Before terminating in the axillary vein, the cephalic vein exhibits a characteristic curve (due to the deltoid and pectoralis minor muscles).

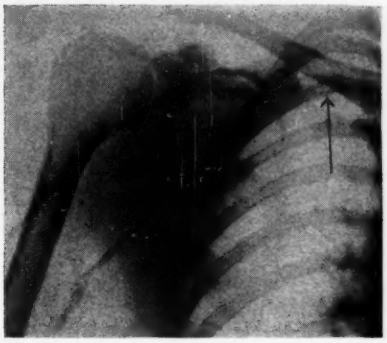

Fig. 7. Normal venogram. The basilic, brachial, axillary, and cephalic veins can be seen and the dye traced beyond the first rib into the subclavian vein (arrow). There are no valve dilatations; the distal half of the axillary vein is apparently narrow, while more proximally it shows reduplication. The cephalic vein displays its characteristic curve.

thors have also recorded a lowered blood pressure in the involved arm (71, 89, 101, 103, 126, 139, 218). On the other hand, Veal and Hussey (207) have found that the sphymomanometer reading is often from 10 to 15 mm. of mercury higher on the affected side and this is confirmed by the observations of others (39, 51, 131, 132, 136, 139, 175, 196, 218, 222). Clute and Rixford have both observed considerable differences between the readings from the two arms.

Oscillometry. The oscillometric index has been measured by a number of investigators but the readings have varied. The index may be increased (39, 101, 102, 177) or decreased (17, 37, 101, 103, 104), or there may be no detectable difference between the two sides (73, 74, 78, 101, 162, 177, 216). In one of Roelsen's patients a normal reading was observed at rest but during exercise the index became greater in the affected arm (177).

Temperature of arm. A rough clinical estimation of the temperature of the affected arm has been made by many, but very few accurate recordings have been attempted. Freidland and Farber, and Roca and Lazaroni have found the arm to be warmer when measured with the thermocouple, whereas Horton noted it to be from 0.2 to 1.0 degree C. cooler. Many writers have had the impression that the arm was cooler but others have found it to be warmer.

Venography. Exept on the rare occasions when a cervical rib (4, 83, 134, 162), an aneurysm of the aorta (119, 197), or some such other cause for obstruction to the venous flow from the upper extremities has been detected by direct roentgenography, this line of investigation has been of surprisingly little value. Blood vessels are only displayed by such means when their walls are calcified, so that it is necessary to employ radiopaque solutions as used in urography in which the iodine complex is organically combined and thus rendered comparatively inert. Other substances have been employed with equally good effect, e.g., diodrast (102, 198) and colloidal thorium dioxide (16, 101). The author uses a 50 per cent w/v solution of "pyelosil" (diodone) which contains 49.8 per cent, by weight, of iodine.

One of the veins in the cubital fossa is selected for the injection. Andersson believes that injection into the median basilic vein results in the most satisfactory picture. This vessel courses proximally on the medial side of the arm and pierces the deep fascia at about the level of the deltoid tuberosity to join a vena comitans of the brachial artery; the resulting venous trunk after a short course is further augmented by the profunda vein before terminating in the third part of the axillary vein. Kaplan and Katz (103) and others prefer to use the median cephalic vein which runs up the lateral side of the arm into the groove between the deltoid and pectoralis major, pierces the clavipectoral fascia on the medial side of the pectoralis minor, and finally enters the axillary vein, frequently in conjunction with the acromiothoracic vein. Others have selected the median cubital vein which connects the former two vessels and usually

Fig. 8. Normal venogram. The basilic, brachial, and axillary veins and the distal half of the subclavian vein are visualized (arrow). The dye shadow becomes thin at about the site of entrance of the cephalic vein; the latter vessel is not seen.

Fig. 9. Normal venogram. The basilic, brachial, axillary, and cephalic veins are easily seen; the distal half of the subclavian vein (arrow) is visualized. The third part of the axillary vein shows an apparent narrowing of its lumen. There is a localized dilatation of the first part of the axillary vein due to the valve which is present here.

communicates with the brachial venae comitantes.

A percutaneous technique is used, although Roelsen (178) and others have exposed the vessel when necessary. A 20 c.c. syringe with an eccentric nozzle is fitted with a 20 gauge needle and filled with the medium. The patient is recumbent with the arm held at 45 degrees abduction. As the dye is rapidly diluted an exposure is taken while the injection is proceeding, 5 c.c. being sufficient to display the veins; however, to ensure visualization of a maximum number of vessels, a further exposure is taken immediately after the entire 20 c.c. have been injected. Finally, a third exposure is made 30 seconds after the injection is completed to ascertain if any stasis of the blood stream exists.

Normal venograms show considerable variations but there is usually an even, although unequal, filling of the basilic, brachial, axillary, and cephalic veins. The opaque medium gradually decreases in density and often disappears in the region of the clavicle because of its dilution by blood flowing in from large tributaries. The subclavian vein, therefore, is frequently not visualized except in its third part. Several valves may indicate their presence by localized, uniform swellings of the veins (Figs. 6, 7, 8, and 9).

When venous obstruction is present, the injected solution enters the collateral vessels and, as one would expect, these are almost invariably well displayed in venograms of such conditions. The collateral circulation is usually most apparent on the lateral aspect of the arm and sometimes markedly so (67, 101, 103). It often extends well into the neck and is well displayed in the cases reported by Hauge and Kaplan (102). The vessels may be markedly dilated and extremely tortuous (72, 101).

The basilic vein may not fill (178); it may be visualized in its lower portion only (37) or to the point where it pierces the deep fascia in the arm to join the venae comitantes of the brachial artery (16). Kaplan (101), Willcutts and Shelburne, and Bruce have noted distention of the basilic vein, most marked above the valves present in the vein. There is no constant appearance of the axillary vein. Stabins described it as "thread-like"; Roelsen (178) observed that "at the level of the axillary fold is an abrupt ending which continues as very weak and irregular streaks of contrast medium" and in a further case that "there is a poorly filled vein suggesting the axillary vein." Kaplan (101) noted a venous segment which appeared to be a narrowed axillary vein, and Perlow and Barth described a case with "abrupt narrowing of the axillary vein—the lumen is about one-eighth that of the distal portion of the vein and is irregular." On the other hand, in the second case of his second series Roelsen (178) observed partial filling of the basilic, brachial, and axillary veins with the dye lying as a thin coat along the walls of the vessels; "the lumen is filled centrally by nonshadow-giving mass which can be followed as a cord in the brachial veins from the elbow to the inlet in the axillary vein and for some distance beyond." In another case the same author noticed a large defect in the same vein. Many writers have stated that they have been unable to visualize the axillary vein at all (16, 37, 67, 68, 101, 102, 103, 158, 178). Willcutts and Shelburne and Bruce observed dilata-

Fig. 10. Venogram of recent case of venous obstruction. The cephalic vein is visualized and the dye can be traced from the termination of this vessel into the axillary vein as far as the middle of the subclavian vein. The basilic and axillary veins are not visualized. Collateral vessels enter both the cephalic and axillary veins. The dilatation of the cephalic, the presence of collaterals entering this vein as well as the terminal portion of the axillary vein, and the presence of dye in the subclavian vein all indicate obstruction in the proximal half of the subclavian vein. Thrombosis of the axillary vein, which may be present, is a secondary phenomenon due to stasis and intimal injury from overdistention.

tion of the vein presumably due to an obstruction at a higher level, while Mason, Hauge, and Pelner and Cohn claimed to have located the obstruction in the region of the first rib. Demel and Sgalitzer reported a case in which the venogram showed a slight indentation of the subclavian vein which they regarded as due to an apical lesion, while in another they could demonstrate contrast defects due to a thrombosis of the brachial and axillary veins, and partial thrombosis of the subclavian vein.

The cephalic vein is frequently displayed when the median basilic or median cubital veins are injected, although a separate needle into this vein may be required. Ditter and Walker visualized the whole of the cephalic vein in their case, but at its termination it did not appear to empty into the axillary vein but assumed a collateral and devious course to enter the external jugular vein. Some have been able to demonstrate this vessel to the region of the clavicle (16, 136, 178), and others to the upper third of the humerus (67, 103, 158). Kaplan (101) visualized the vessel to the junction of the upper one-third and lower two-thirds of the humerus at which point there were numerous collaterals on the lateral surface of the arm; a venous segment could be seen at the point

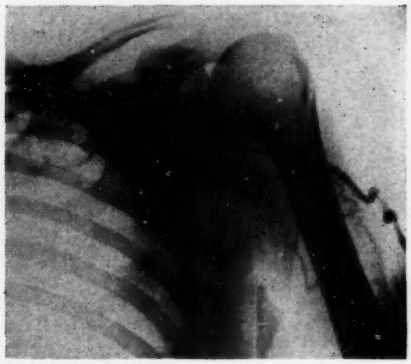

Fig. 11. Venogram of a long-standing case of venous obstruction. The dye passes proximally by way of collateral vessels. The cephalic vein is tortuous and ends, not in the axillary vein but in a vein which crosses the clavicle to join the external jugular vein.

where the cephalic vein should enter the axillary vein. Roelsen (178) injected one patient 3 days after the onset; the median cubital vein was selected with the needle directed toward the basilic vein. All the solution ran back into the cephalic vein, which filled and continued in a well developed collateral circulation in the deltoid region. The same author noted in 2 other patients that the vessel was much more distended than usual (Figs. 10, 11, 12).

The only constant feature of these venograms is the overdeveloped collateral circulation and Loehr (125) has emphasized that such cannot be taken as conclusive evidence of thrombus formation but rather of venous stasis. Roelsen (178) believes

Fig. 12. Venogram of external jugular in recent venous obstruction. There is no evidence of obstruction to the external jugular vein indicating a more distal obstruction.

Fig. 13. Venous obstruction of the right arm.

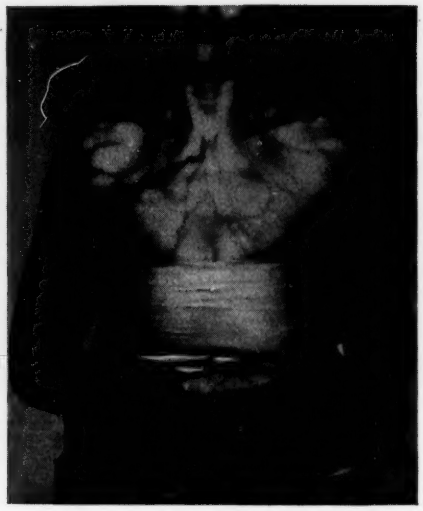

Fig. 14. Same case as in Figure 13: infra-red venography.

there are several factors which account for the varying results. The time after the onset at which the venogram has been performed has varied widely and he believes that in some cases a thrombus may have undergone organization and recanalization "leaving merely some minor changes in the wall of the vein, not able to give a characteristic picture." A thrombus localized to the subclavian vein, a lesion which cannot be verified radiologically, will complicate preconceived ideas as to the interpretation of a venogram; and irritative factors may influence the configuration of the main vessels as well as the collaterals.

In one of Zehnder's patients there was no difference between the venograms obtained from the normal and abnormal arms; while Roelsen (178) also had a normal venogram, although there was some evidence of stasis.

It is difficult, in view of these findings, to agree with Stabins and others who claim that a venogram shows the site of obstruction and the adequacy or otherwise of the collateral circulation, and hence is a useful investigation. It may indicate where the obstruction begins but it is impossible to judge from the film either its extent or its cause. The efficiency of the collateral circulation is estimated much more satisfactorily by exercise tests and by observing the relation of the latter to the functional ability of the arm. Neither the diagnosis nor the selection of the correct treatment can be influenced by a venogram.

Roelsen (178) observed an aggravation of the swelling in 2 cases after a venogram had been carried out and attributed this to a chemical phlebitis superimposed on the pre-existing stasis. Robb and Steinberg investigating a patient with a cardiac condition, injected diodrast into the veins of an arm and this also was followed by an acute thrombosis of the main veins of the limb. Moreover, complications (local or general) may follow the injection of any substance intravenously.

Infra-red venography. Superficial veins are clearly displayed by infra-red photography and the overfilled veins characteristic of this syndrome are well demonstrated (Figs. 13, 14, 15, 16, 17, 18).

Constitutional disturbances. Constitutional disturbances have been conspicuous by their absence; in fact, there is a considerable contrast in the appearance of the arm, swollen and cyanotic, and in that of the patient, in otherwise normal health. It is true that cases occur in which there is an associated constitutional reaction. For instance, McGoogan and Simmons reported the case of a woman of 42 years, suffering from chronic nephritis and toxemia of pregnancy, who on the fourteenth day after delivery developed axillary and subclavian thrombosis. This was believed, by the authors, to be due to the patient's pulling herself up by grasping the bar at the head of the bed. Her temperature rose to 99.6 degrees and her pulse to 146, and the latter continued to range between 120 and 140 for a week. Wilson recorded a temperature ranging between 99 and 104 degrees in one of his cases. However, in the few instances in which the temperature was elevated, it was almost always a transient and very slight rise.

Fig. 15. Venous obstruction of the left arm.

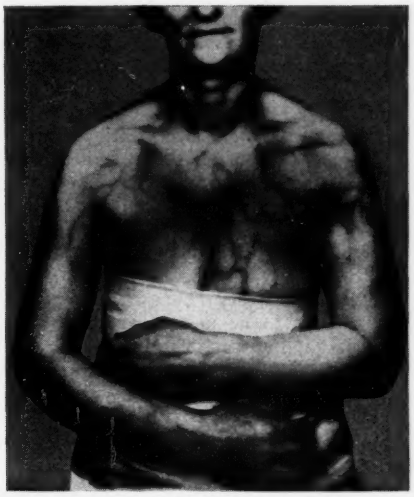

Fig. 16. Same case as in Figure 15: infra-red venography.

In McGoogan and Simmons' patient the tachycardia was extreme, but usually the pulse is quite normal even when a mild pyrexia exists.

Several authors have reported cases with a very slight leucocytosis (74, 80, 84, 107, 129, 173), but this was not present in other patients, even those with fever. In no case have any other abnormalities been detected in the cellular content of the blood (except for those noted later and reported by the authors Winterstein and Stover and Herrell).

The blood sedimentation rate has been determined in some cases but it has nearly always been within normal limits (48, 78, 178). Roca and Lazaroni noted a very slight increase of sedimentation in a case 4 weeks after the onset; Roelsen (178) made a similar observation in 4 of his cases, although in one of these the rise could be accounted for by suppuration of the venography wound.

DIAGNOSIS

The recognition of a state of venous congestion rarely, if ever, presents any difficulty. There is a rapid onset of a diffuse, firm, nonedematous swelling of the arm, from hand to shoulder girdle, with distention of the superficial veins and a reddish blue discoloration of the hand and forearm. The symptoms may quickly subside but tend to recur with exercise. Accessory investigations, such as venography, measurements of venous pressure, and oxygen content of the venous blood, as well as oscillometric and skin temperature estimations, confirm the presence of this venous stasis if additional proof be needed, but provide little or no information as to the cause.

Palpation of the axilla may reveal tenderness and frequently there is a thick firm tender cord occupying the course of the axillary vein; there may be some tenderness and even a "cord" in the supraclavicular region and down the inner side of the arm. A roentgenological examination is nearly always negative. The patient presents a healthy appearance without constitutional disturbances.

However, venous obstruction may occur in the upper extremity as a complication of certain easily recognized conditions.

Cardiac failure. Thrombosis of the main vessels of the upper extremity may complicate cardiac failure but this is rare. It was first described more than 100 years ago by Bouchut, subsequently by Welch, Blumer, and others, and more recently by Esselhorn and Janchar, and Veal and Hussey (207), the latter reporting 16 such cases. In all these, however, the involvement of the arm has been but an incident, and frequently a terminal incident, in the illness of a patient obviously suffering from serious congestive cardiac failure.

Mediastinal compression. Several cases have been reported complicating an aneurysm of the ascending aorta (119, 197). Other patients have had positive Wassermann reactions but without evidence of an aneurysm (45, 64, 141, 181, 201, 222); in one such case Huard believed the condition to be secondary to a syphilitic mediastinitis, but 6 months later an aortic aneurysm was discovered. A mediastinal tumor is more likely to result in compression of the left innominate vein and cause hypertension in both the jugular and

subclavian distribution; the superior vena cava itself may be involved. The history, and the clinical and roentgenographic examination render the diagnosis a comparatively easy matter in these cases.

Axillary compression. Metastatic glands from a primary carcinoma of the breast sometimes cause swelling of the upper arm which may be due to pressure on the main venous trunks or to blockage of the lymphatic vessels. Lymph glandular enlargement from other causes rarely results in serious compression of the axillary vein. Aneurysm of the axillary artery (45), axillary hematoma (143), or scar tissue is an occasional cause of venous stasis, but such lesions are obvious on examination.

Swelling of the upper extremity without signs of venous stasis may occur in extensive cellulitis and lymphangitis. Severe injuries of the brachial plexus causing paralysis of the upper extremity may be accompanied by a temporary swelling of the arm. Cerebral monoplegia, syringomyelia, radiculitis, and hysterical edema have been mentioned, but none of these conditions can ever be a source of confusion in diagnosis.

Arteriovenous aneurysms may cause enlargement of the limb with dilatation of the superficial veins; the diagnosis can be made from the history and by the presence of a tumor over which there is a thrill and a murmur. If need be, confirmation of the diagnosis is provided by further investigations, such as estimation of the venous content which is raised in this condition.

COURSE AND COMPLICATIONS

The acute symptoms of the syndrome subside after a comparatively short interval, varying from a few days to a few weeks. As the swelling decreases, the collateral circulation becomes more obvious. Complete recovery, which implies not only functional recovery but also the disappearance of all pain, swelling, and discoloration, and the return to normal of the superficial venous system, has been claimed by many, but a critical study of the cases, combined with a careful follow-up, leads one to doubt whether this ever happens; however, the majority, perhaps, ultimately enjoy freedom from symptoms.

So far as it is known, no death has occurred in any case of the Paget-Schroetter syndrome. Moure (142) reported a fatal pulmonary embolism which originated from a thrombus in the axillary vein in a woman of 71 years, 4 days after she sustained a fracture of the humerus.

Tomasi's patient was a man of 45 years who complained of a recent onset of swelling and discoloration of the right arm. He had been ill at intervals for many years and only a month previously had suffered from an attack of pleurisy. His condition deteriorated and, as his arm was becoming progressively swollen, it was disarticulated at the shoulder. The patient died some days later and autopsy revealed an empyema, multiple thrombosis, pulmonary embolism, and necrosis of part of the arm.

Remijnse reported a somewhat similar happening in a patient of 60 years who died a few weeks after admittance to the hospital. Autopsy revealed thrombosis of most of the large veins, endocarditis, pneumonia, and gangrene of the arm.

None of these cases resembled those under consideration and they therefore belong to a different category. So also do the cases with congestive cardiac failure reported by Veal (206), Esselhorn and Janchar, and others. Veal and Hussey (208) found such a high incidence of fatal pulmonary embolism in such cases that they suggested ligature of the subclavian vein.

Nonfatal pulmonary embolism. This is of extraordinarily rare occurrence, if indeed it ever occurs. Despite the absence in most cases of any special treatment, embolism has been reported in only 3 patients. Schepelmann (190) removed a thrombus from his patient and 5 weeks later a pulmonary embolism is said to have occurred. It is of significance that the patient, a man of 22 years, suffered from mitral insufficiency and bradycardia, so that two abnormal factors were present—operative trauma and cardiac disease. Roelsen (178) treated 3 patients with heparin and one of the recipients, who previously had an exacerbation of phlebitis following a venogram, developed pulmonary signs believed to be due to infarction. Neij reported embolism in one case but gave no details.

Involvement of the opposite arm. This is also an unusual event, although 6 such cases (2%) have been reported, 2 by Kux (107) and 3 of the remainder by British authors. Firth and Mackay reported the case of a girl of 19 years who developed the condition in the right arm after stirring a pudding; 19 months later the left arm became involved although there was no precipitating factor on this side. Selim recorded the case of a man of 36 years in whom the right arm was first affected and 6 weeks later swelling and discoloration appeared in the left. Belilios and Houghton reported the case of a man of 24 years who after a gradual onset in the right arm suddenly experienced swelling and discoloration of his left.

Fig. 17. Venous obstruction of the left arm.

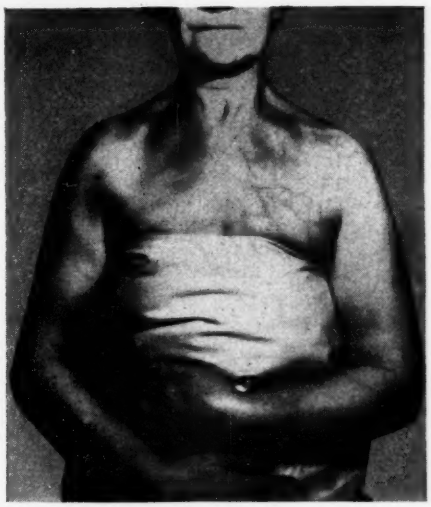

Fig. 18. Same case as in Figure 17: infra-red venography.

Recurrence of symptoms. Matas gave an account of a man of 26 years who strained his right arm at work. The patient experienced pain, followed by swelling of the arm; the swelling subsided later but each time he returned to work the pain and swelling recurred, and this happened over the whole period that the patient was observed (4 years). The same writer reported similar exacerbations in another patient observed for 12 years and many others have had the same experience (11, 16, 61, 70, 78, 79, 84, 101, 130, 150, 171, 177, 184, 215). Veal (206) reported persistent recurrences in 3 patients followed for 6, 10, and 22 years, respectively. Recurrences always follow exercise, unlike the original attack, and are to be attributed to inability of the venous collaterals to respond to the increased flow of blood through the arm, rather than to further injury to a vein which has been incompletely occluded by the initial trauma.

Persistence of symptoms. Swelling, discoloration, and obvious collateral veins are permanent to some degree. Slight swelling need cause no discomfort to the patient and is easily overlooked. Prominent collateral veins merely signify that the body's compensating mechanism has performed its task more or less efficiently. However, pain and discomfort frequently persist and may partially disable the patient. It is possible to segregate arbitrarily only the recurrent symptoms from the persistent, for the former imply a collateral circulation sufficient for all but vigorous work, and the latter, a compensation that is less efficient. This view is more rational than one visualizing varying degrees of absorption and recanalization of a thrombus (11, 84, 159, 171), which has not been proved to exist in all cases.

Many cases have occurred in patients engaged in heavy employment, and as there is a tendency for the symptoms to persist or recur, several protracted medicolegal arguments have followed, with the judgment usually in favor of the patient (79, 131, 150, 171, 179), although in Ljunggren's case the etiological importance of trauma was successfully contested.

ETIOLOGY

The most common cause of venous obstruction in the lower extremity is a thrombus but it is doubtful whether such obstruction produces this condition in the upper extremity. It is true that in many of the cases subjected to operation a thrombus has been found in the axillary or subclavian veins. Schepelmann (190), Bazy, and others have incised the venous wall and extracted clots, while some surgeons have excised part or the whole of a thrombosed segment. Some of these specimens removed at operation have been examined histologically. For example, Roelsen (178) found the vein to be almost completely obliterated, with a narrow central lumen surrounded by granulation tissue containing phagocytes; other sections showed more recent thrombosis. Lapeyre noted considerable intimal

proliferation, partial rupture of the venous wall, and an organizing thrombus.

Frequently, however, the surgeon has found no thrombus. In one of Roelsen's cases (177) the subclavian vein was explored but there was no sign of any thrombus; a few months later the axillary vein was exposed and it likewise was perfectly normal. The symptoms and signs of venous stasis persisted after the operation. In another case of the same author, an exploration of the axillary vein failed to reveal any thrombus although the vessel and its tributaries were dilated; in a third case the subclavian vein appeared quite normal and no thrombus was seen. The subclavian and axillary veins were explored in Ljunggren's case and there was no evidence of thrombus formation. Puhl had a similar experience; he operated on 2 patients 2.5 months and 8 months, respectively, after the onset, and found the walls thickened but no thrombosis. Hauge explored the third part of the subclavian vein through a subclavicular approach; no thrombus could be felt and the venous walls were of normal appearance. Wulsten (220) found the axillary and brachial veins dilated but there was no intravascular clotting. Others have recorded similar experiences (39, 122, 125, 136, 143, 163).

In reviewing these findings one must be careful to remember that the extent of the exploration is often uncertain from the description of the operation. It is conceivable that a small thrombus was present in an inaccessible part of the vein. The problem is further complicated by such instances as that reported by Wulsten (220) in which palpation revealed a tender tumor in the axilla; it was believed to be a thrombosed vein, yet at operation the vein was normal. Roelsen (178) suggests that certain clinical differences exist between the thrombotic and nonthrombotic cases; in the former group he thinks that the precipitating trauma is negligible and that the patient frequently has a mild elevation of temperature. However, there are many exceptions to this and such a partition appears to be wrong.

Whether thrombus formation be of primary or secondary importance its cause must be sought. Winterstein and Stover and Herrel both reported cases of polycythemia presenting with thrombosis of the axillary and subclavian veins; the latter reviewed the literature and found that this was such a rare association that only one similar case had been reported (a patient of Parkes Weber). In no other case has a full examination of the blood, either chemical or cytological, revealed any predisposing cause whatever and this possibility may be dismissed.

A few authors believe that slowing of the blood stream is an important factor. Lowenstein and Schwindt considered that the presence of valves within the veins and fixation of the venous wall to the costocoracoid ligament, the clavicle, and the rib, retarded the rate of blood flow. As pointed out previously, cardiac failure may be complicated by axillary and subclavian thrombosis, and Ruge considered that such could be regarded as an early manifestation of circulatory failure. Humphry described such a complication in the terminal stage of a debilitating illness in a girl of 19 years and "... in a man of 45, who died of phthisis, the right upper extremity having for some days been oedematous, and the superficial veins of the arm and shoulder distended, we found the subclavian vein, near its junction with the internal jugular, blocked up by a tough brown clot, which was adherent to the interior of the vein ..." Blumer described a similar case and reviewed several others from the literature. These cases are seemingly terminal events and differ fundamentally from those considered here in which the patients are healthy active people, in whom any general blood stream stasis may be at once excluded.

Most attention has centered around the possibility of an abnormal venous wall which acts as a focal point for thrombus formation and a few believe that infection is the cause. Wilson recalled the rarity with which phlebitis occurs in the upper extremity in typhoid fever, but stressed the importance of syphilis. In support he quoted Marcel Gaugard who reported 2 cases of subclavian thrombosis, and Muscher whose patient developed brachial thrombosis; all 3 patients were syphilitics. Gould and Patey (70), Sloan and Roberts, Leocadio, and Huard (88) have reported thrombosis of the upper extremity complicating an aneurysm of the aorta, while others have had patients with positive Wassermann reactions but without aneurysmal formation (45, 64, 141, 181, 201, 222). Paget and Leriche prescribed antisyphilitic treatment in their cases although there was no evidence of the infection. Humphry was the first to report the condition in tuberculous patients; Aldrich collected 9 cases from the literature and added one case of his own; other cases have since been described (217). This occasional association of specific infections with subclavian and axillary thrombosis provides no significant information on the etiology of the Paget-Schroetter syndrome.

The theory of nonspecific infection was advanced by, and received considerable support from, French authors (2, 30, 97, 115, 118, 183).

Lecene considered that the alleged trauma was usually too trivial, while Lenormant (117) and Ducuing suggested that the role of injury was merely to activate a subclinical infection. In support of an infective origin is the unquestionable fact that some of the patients have fever; a few have displayed leucocytosis; and the blood sedimentation rate may be elevated. Forster's patient and one of Sampson's (184) suffered from chronic sinusitis in addition to the axillary thrombosis; other cases also have followed an upper respiratory tract infection (43, 67, 72, 95, 106).

Several histological and bacteriological examinations have been cited as favorable evidence for infection. Huard and Lenormant (89) reported chronic inflammation of the walls of the vessels, most marked around the vasa vasorum. Chifoliau and Folliason noted many leucocytes in the venous wall, and microscopic examination of the resected portion in Herbrand's case also suggested latent sepsis. In Lenormant and Mondor's specimen (118) it was said that it was actually possible to see staphylococci about the vasa vasorum. Patel and Morel Fatio resected 12 cm. of a thrombosed segment and histological examination revealed recent thrombosis with partial organization and moderate infiltration of the vessel wall with leucocytes, while staphylococci were obtained from a culture. Chifoliau and Folliason cultured the staphylococcus, Grimault and Dantlo the streptococcus viridans, and Lenormant and Mondor (118) obtained a very feeble growth of the staphylococcus albus and the colon bacillus. Broca reported that the axilla appeared inflamed at operation; Biebl found a lymph gland in such close connection with the venous walls that it had to be removed by sharp dissection, and examination of the gland later revealed a subacute nonspecific inflammation. Both Biebl and Rosenthal believed that the close proximity of these glands to the axillary vein provided an easy opportunity for direct transmission of infection. Girard (66) and Wulsten (220) observed patients with septic hands, but with mild infection, on the same side as the lesion.

However, the evidence is against infection in any but the occasional case. Most of the patients show no systemic reaction at all; the temperature, pulse, white blood cell count, and sedimentation rate are normal. This disproportion between the local condition and constitutional disturbance is one of the remarkable features of the syndrome. Moreover, specimens obtained at operation have on many occasions proved sterile. Axillary thrombosis is a rare condition; yet axillary adenitis secondary to infections of the hand is common.

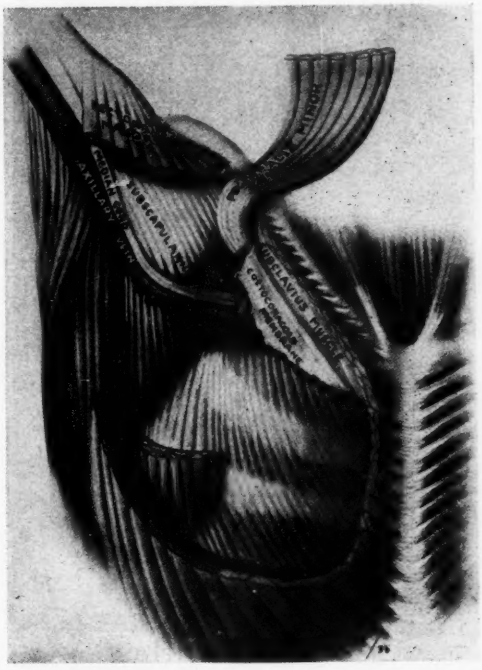

Fig. 19. Veal and McFetridge (209) believed the axillary vein was constricted against the subscapularis muscle with stretching of the vein just proximal to the point of constriction. (*Archives of Surgery.*)

Most authors believe that trauma is responsible; the intima is damaged and a thrombus forms. Although the condition has followed a direct injury varying from a mild blow on the arm or shoulder to severe crush injuries of the chest (26, 40, 44, 81, 101, 107, 126, 154, 155, 158, 171, 218), it has much more often been induced indirectly. The onset has frequently occurred at the time of, or soon after, lifting a heavy weight (Table I). On the other hand, Stabins reported an example in a man working with his arms above his head installing an air plane motor; Lenormant and Mondor (118), a painter at work on a ceiling; Ffrench, a patient who was in the habit of reaching for objects; Roelsen (178), a man who lifted rolls of cloth from shelves; Gould and Patey (70), a clerk who considered his swollen arm to be a sequel to the insertion of 18 screws into a wall above his head, and another case which was attributed to the placing of jars on a high shelf; and De Bakey, Ochsner, and Smith believed one of their cases was caused by the patient's sawing a tree with his arm above his head. Hartmann

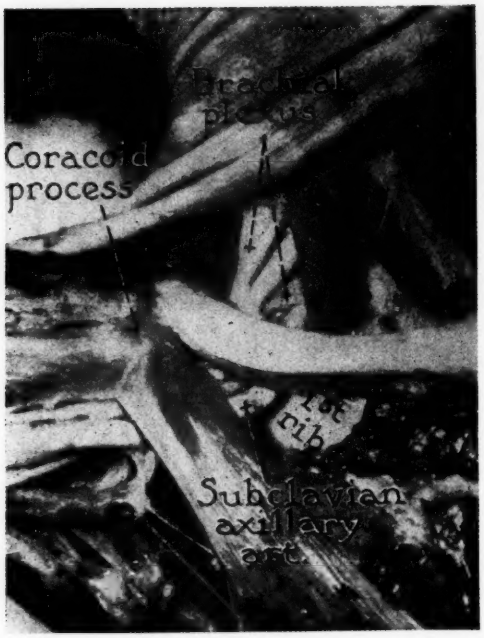

Fig. 20. Wright (219) considered that the vein was damaged as it passed posterior to the pectoralis minor muscle beneath the coracoid process. (*American Heart Journal.*)

described an onset which followed an extra strain to push a bed past an obstacle; McGoogan and Simmons and O'Regan, instances due to strenuous pulling efforts. It may follow such sustained movements as washing clothes (179, 207) or dishes (184); swinging a sledge hammer (216) or a 25 pound hook (171); pitching soya beans (132) or stirring a heavy pudding (61); digging a hole with a crow bar (86); beating time with a baton (43); prolonged carving (56); pushing and pulling heavy silk measuring machines (102); overtime in iron smith work (152); or bell ringing (162). It has been reported in tennis and squash players (23, 184, 201), golfers (70), baseball players (84, 101, 130, 184), rowers (200, 215), boxers (163), swimmers (3), basket ball players (158, 178), and those engaged in gymnastics (12, 36, 59, 98, 139, 149, 177). It has been noted in drunkards (33, 143, 215), and in epileptics (106, 216). It may follow as trivial an episode as putting an arm into an overcoat sleeve (128). There may be nothing at all to account for its onset, and no fewer than 39 persons (13% of the number in which the onset is described) awoke with symptoms of the disease (Table I).

Attempts have been made to analyze the movements of the upper extremity and to isolate some specific maneuver common to every case. For example, Taylor believed adduction at the shoulder to be important; Veal and McFetridge (209) and Neij, abduction; and McGoogan and Simmons, abduction and external rotation. Some believe it is a minimal effort (64, 116), others that it is of undue vigor (39, 150).

Several anatomical investigations have been conducted with the object of locating a vulnerable site in the course of the axillary and subclavian veins, and as a result each part of these veins has been regarded, at sometime, as the part at fault.

Veal and McFetridge (209) put forward the view, based largely on venographic studies, that the axillary vein might be damaged by action of the head of the humerus through the subscapularis muscle. This theory has received little support (Fig. 19).

Wright believed the vein to undergo "torsion, stretching, and pinching" as it passed posteriorly to the pectoralis minor and just beneath the coracoid process. The vessel is normally well protected, but in hyperabduction it is stretched around and beneath this process. By the same action the pectoralis minor is drawn tight, and it is suggested that this double action might injure the axillary vein (Fig. 20).

Willan considered the lesion to be in the first part of the axillary vein, that is, in the region between the outer border of the first rib and the medial edge of the pectoralis minor. He thought the vein somehow suffered damage against the rib border during vigorous exercise and that the intima of the vessel was roughened, which determined the onset of thrombosis.

Lowenstein concentrated his attention on that part of the vein lying between the rib and the clavicle. He pointed out that the inferior border of the costocoracoid ligament is sharp, strong and crescentic, and is strengthened by the tendinous fibers in the subclavius muscle. The inferior border of this muscle is fibrotendinous from its costal origin for at least 5 or 6 cm. laterally, and fibrous bands may extend to the coracoid process. As the subclavius muscle and costocoracoid ligament follow the course of the clavicle laterally and posteriorly, they cross the vein. When the arm is abducted to the level of the shoulder, the subclavius muscle and costocoracoid membrane are put on the stretch and the sharp, firm lower border of the costocoracoid ligament exerts considerable pressure on the superior surface of the vein. Lowenstein found that the maximum pressure was brought to bear when the arm was in extreme

abduction, especially when rotated laterally; the indentation, he thought, might be increased by the downward pull of the pectoralis minor. Gould and Patey (70) injected plaster of Paris into the axillary veins of postmortem subjects, the arms of which were held in fixed abduction. In one instance a shallow groove was obtained in the cast, corresponding to the position of the costocoracoid ligament, while in 2 other cases a deep broad groove from pressure of the subclavius was seen. Lowenstein also noted that as the axillary vein crossed the shelving upper surface of the first rib it was provided with a valve; Gould and Patey (70) found this to be a fairly constant structure and suggested that its rupture, a consequence of pressure, was the fundamental pathological lesion. Hughes, however, found that with abduction of the arm the clavipectoral fascia, which stretches between the costocoracoid ligament and the pectoralis minor, pulled the former ligament away from the vein; he was unable to detect any significant compression of the vein between the subclavius muscle (and the costocoracoid ligament) and the first rib.

Falconer and Weddell believed that the subclavian vein was compressed between the clavicle and the rib. They demonstrated that backward bracing of the shoulders sometimes led to distention of the superficial veins of the limb with opening up of the collateral venous channels across the pectoral region to the veins of the neck. The offending movements were, firstly and the more important, backward and downward bracing of the shoulders, and, secondly, hyperextension of the neck, which probably also narrows the angle between the first rib and the clavicle. In this maneuver the scalene muscles may play the part of an elevator of the anterior end of the first rib (Fig. 21). Judovitch, Bates, and Drayton favored this theory and referred to 2 cases in which the axillary vein was found to be dilated to one and a half times its normal size on the lateral side of the first rib. Others have also believed that in certain actions the clavicle compressed the subclavian vein against the rib (9, 200). However, Hughes did not support this view for he noted that as the clavicle approached the rib, the subclavian vein slipped forward under the clavicle and away from the maximum pressure zone. Telford and Mottershead found that in normal subjects it was necessary to sever the intra-articular disc in order to approximate the rib and clavicle, although such compression might be important if the costoclavicular interval was already narrowed. In this connection it is of interest to note that cervical ribs are rarely found in cases of venous ob-

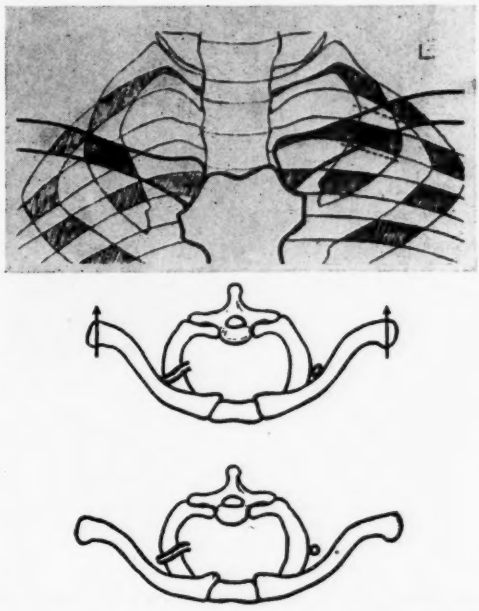

Fig. 21. Falconer and Weddell (54) thought that the vein might be compressed between the rib and clavicle (a), particularly in the presence of an abnormal first rib (b). (*Lancet*, Lond.)

struction of the upper extremity, although their presence has often been suspected. Hermodsson observed a patient with a cervical rib and McGoogan and Simmons noted the suggestion of a cervical rib in their patient. In Pinelli's case the abnormality existed on both sides and was more prominent on the side of the venous stasis, while Andersson mentions a patient presenting a cervical rib syndrome, with occasional swelling and signs of mild venous stasis in both arms.

Loehr (125) suggested that there was a "relative" obstruction at the hiatus between the rib and the clavicle. Nearly all the blood from the upper extremity must pass through this narrow space in order to reach the caval circulation. Loehr considered heavy exercise caused a "constriction" at this point, which was aggravated by the increased thoracic pressure. The subclavian vein surrounded by strong fascia is prevented from overexpanding while the axillary vein, which lies free, is acutely overdistended; a vein so damaged does not recover quickly, but tends to remain dilated for several days and, furthermore, it is more easily distended a second time and subsequently. Loehr visualizes the resulting edema

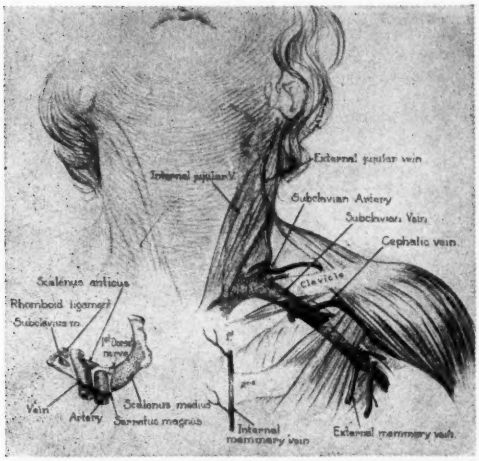

Fig. 22. The relation of the subclavian vein, subclavian artery, and adjacent structures. Sampson, Saunders, and Capp (185) drew attention to the narrow interval between the subclavian vein and medial border of the scalenus anterior. (*American Heart Journal.*)

compressing the vein and so causing a vicious circle of changes.

Sampson, Saunders, and Capp (185) pointed out that as the subclavian vein lies between the scalenus anterior and the clavicle, it occupies a very narrow space, which in the adult is scarcely 1.5 cm. wide. They considered that this part of the subclavian vein might easily be compressed, but that vascular occlusion was also partly a result of the veins becoming stretched over the rib. These authors suggested that high, wide first ribs and horizontal, backwardly directed clavicles were important predisposing factors to the development of venous thrombosis and were constant features in such patients (Fig. 22).

However, these theories so far considered seem inadequate. No typical movement or combination of movements preceded the onset of the condition which, indeed, may follow a period of relative inactivity. Surgical exploration has frequently disclosed no sign of a thrombus at all, yet there is every indication that the obstruction is permanent and that the degree of disability depends on the inefficiency of the collateral circulation. It is remarkable that no definite instance of embolism has been reported; a movement of the shoulder girdle which is sufficient to traumatize the vein and cause a thrombus should also be capable of detaching part or all of that thrombus.

Hughes has suggested that a prevenous phrenic nerve might obstruct a subclavian vein. The phrenic nerve possesses considerable tensile strength; even a tiny accessory phrenic nerve may damage the subclavian vein when it is avulsed. Usually the phrenic nerve passes posteriorly to the subclavian vein, but it may pass anteriorly (55, 87, 188). This prevenous phrenic nerve occupies a more lateral position than a normal nerve; it curves forward around the tendon of the scalenus anterior and after crossing the subclavian vein immediately turns posteriorly to enter the superior mediastinum (Fig. 23). The nerve bears an intimate relation to the vein and may even pass through its wall (87, 167, 188). With inspiration, contraction of the scalenus anterior and elevation of the first rib accentuate the abnormal angulation of the prevenous phrenic nerve; as a result of the increased tension on the nerve caused by descent of the diaphragm there is a strong tendency for the subclavian vein to be nipped against the tendon of the scalenus anterior by the nerve. As the right phrenic nerve takes a shorter and more direct course to the diaphragm, and since the excursions of the diaphragm and the first rib are greater on the right side and in males (41), the characteristics of incidence receive an explanation. Such a venous constriction could occur in the absence of any effort; the deeper breathing associated with sleep might precipitate it, as might unusual extension of the neck. Subclavian and axillary thrombosis may or may not occur as a complication, but thrombosis proximal to the obstruction (and hence embolism) is rendered improbable or impossible by the site of obstruction near the junction of the subclavian and internal jugular veins. Hovelacque and his colleagues have suggested that a prevenous nerve may cause injury to the external jugular vein; Hughes submits that it should be considered as a cause of venous obstruction in the upper extremity (Fig. 24).

Other extravascular structures have been described as obstructing the vein. Such observations must be accepted cautiously as any unyielding tissue in close relation to a distended vein might give the impression that it is constricting the vessel. Wulsten (220) divided an axillary arch as it passed between the latissimus dorsi and the pectoralis major. Fascial strands in contact with the vein were found by Ljunggren, Wagner, and Neij. Loehr (125) removed a group of glands from his patient and believed they were pressing on the axillary vein. Demel and Sgalitzer interpreted a venogram as "apical adhesions indenting the subclavian vein". One of Heinecke's patients showed excessive callous formation after a fractured clavicle; Hauge noticed a small osteoma of

the clavicle in one case; and Clifton reported venous stasis of the upper limb due, in part, to an enlarged subclavius muscle and, in part, to a traumatic posterior subluxation of the clavicle.

Rosenthal and Pellot (156, 157) believed that inco-ordinated muscular action could detach venules from the main veins and so cause the intimal lesion necessary to initiate thrombosis. Lahaussois suggested that a sudden muscular contraction resulted in such an abrupt rise in the intravenous pressure that the vessel wall was ruptured. Moure and Martin (143) at an operation performed 7 weeks after the onset found no thrombus, but the inner edge of the coracobrachialis muscle showed signs of considerable bruising and it was thought that a hematoma had compressed the vein. Cadenat and Veal (206) considered that forced expiration could, in certain circumstances, damage the vessel. Pavlovsky suggested that the injury was sustained at the point where the subscapular and the circumflex humeral vessels drain into the axillary vein; at this point the vein widens and presents a region of comparative stasis.

The role of spasm of the vessels in producing the clinical features of this condition is uncertain. There is some evidence that venospasm exists in many cases. Lapeyre and Cottalorda consider that vasospasm provides the only reasonable explanation for the rapid onset and the rapid recovery that might occur. The latter believed the operative findings corresponded with those found in interventions for vasomotor lesions and were caused by a focus of irritation in the perivenous tissues or actually within the lumen of the vessel; it was an upset in the vasomotor equilibrium due to this focus which caused the edema rather than any obstruction of the vein. Based on these considerations, Cottalorda and others have excised a portion of the vein, or have performed a perivenous or periarterial sympathectomy. Instead of removal of this supposed focus of irritation or interruption of the sympathetic nerves by operative means, the assumed pathway of impulses may be blocked centrally by injecting the paravertebral sympathetic chain with novocain. This sympathetic block can have no influence over the venous obstruction if it is due to thrombosis; it may have a favorable effect on the peripheral circulation (147, 207); but its chief value seems to result from the dilatation of the collateral vessels which it causes.

Fig. 23. A prevenous phrenic nerve. The prevenous nerve occupies a more lateral position than the normal structure. It courses forward to cross the vein and then turns sharply backward to enter the mediastinum. It lies lateral to the external jugular vein. On inspiration the contraction of the scalenus anterior muscle and the elevation of the first rib increase the angulation of the nerve, while the descent of the diaphragm tightens the nerve; as a result the vein is nipped against the tendon of the scalenus anterior. (This specimen is now in the Hunterian Museum of the Royal College of Surgeons of England.)

TREATMENT

So few cases are seen in any one clinic that it is not surprising that there is no unanimity of opinion as to the most effective treatment. The problem is complicated by the variation in the course of the illness in the patients that receive no special treatment, some making an apparently complete recovery in a short space of time, others having a protracted course and never regaining normal function of that limb.

No special treatment. In most cases treatment has been symptomatic without resort to any special measures. The patient is usually ordered to bed with the arm elevated. Some believe that active movements are indicated from the outset because it is thought that exercise promotes emptying of the lymphatics and veins, improves the circulation, and discourages propagation of the thrombus; there certainly appears to be no danger of dislodging a thrombus (178, 207, 208). Heat

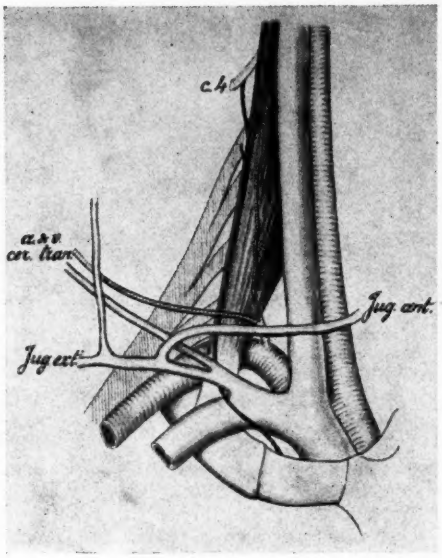

Fig. 24a

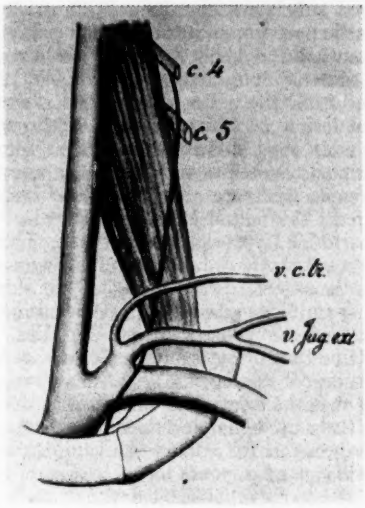

Fig. 24b

(101), ice packs (11), vasodilators (183), elastic bandages (104), and other ancillary measures have been used.

Anticoagulants. In recent years anticoagulants have been administered (6, 21, 90, 98, 114, 139, 178), but the cases are too few as yet to permit evaluation of such treatment. Theoretically, these drugs should retard or prevent the propagation of a thrombus and so leave the patient a maximum number of tributaries which are all concerned in the establishment of a collateral circulation.

Heparin has an advantage over dicumarol in that the anticoagulant effect can be rapidly produced and rapidly stopped, but the latter is less expensive and can be given orally. As dicumarol must be allowed at least 36 hours to produce its effect, it is the author's practice in similar circumstances to combine the drugs initially but to discontinue the administration of heparin after 36 hours.

Heparin (liquemin) is supplied in 5 c.c. vials containing 1,000 Toronto units per cubic centimeter. The contents of a phial are drawn into a syringe containing a little normal saline solution, and 5,000 units are given intravenously at 4-hour intervals for 36 hours.

Dicoumarin (dicoumarin-organon, dispensed in tablets of 50 mgm. each) is started by mouth on admission in a dose of 300 mgm. On the second day it is reduced to 200 mgm. and subsequently a daily maintenance dose of from 50 to 100 mgm. is given with the object of keeping the prothrombin time between 20 and 30 per cent for from 10 to 14 days.

Paravertebral cervical sympathetic block. Ochsner and De Bakey, and Rieder were the first to recognize the value of injecting the stellate ganglion and the upper two or three thoracic ganglia with 1 per cent novocain in this condition, and the former subsequently reported 4 cases in which the patients were so treated. Others have also obtained good results. Bruce noted a dramatic improvement after a single injection in his case, but Ochsner and De Bakey found that two or three injections may be necessary.

The author uses a posterior approach, with the patient either sitting and inclined forward, or lying prone. Three skin wheals are raised two and a half finger breadths lateral to the spinous processes of the seventh cervical and first and second thoracic vertebrae. A 10 cm. needle is inserted at right angles to the skin surface as far as the rib, under which it is maneuvered; it is inclined medially 25 degrees and pushed another 2 or 3 cm. From 5 to 10 c.c. of 1 per cent novocain are slowly injected at each point.

A sympathetic block should certainly be carried out before any other surgical procedure is contemplated.

Operation. Uncertainty in the etiology and pathology is reflected in the uncertainty with which the surgeon has approached this problem. Considerable weight of opinion is against a surgical attack. An exploration of the axillary and subclavian veins is a formidable procedure and each vessel that is divided during the operation, no matter how small it be, is a handicap to the collateral circulation.

Attempts have been made to formulate indications for surgical intervention, such as rapid increase in the swelling (14, 39, 88), persistence of swelling despite adequate rest (14, 39, 122, 178), and recurrence on exercise (97). But in most cases the surgeon has been influenced by the belief that he might find and relieve an obstruction, or eradicate or interrupt a focus of irritation.

Phlebotomy and removal of clot. This has been performed on a few occasions (14, 17, 80, 93, 190). Whether a thrombus be secondary to an extravascular obstruction or an intimal lesion, its removal, partial or complete, will facilitate the establishment of the collateral circulation. However, anticoagulant therapy commenced soon after the onset should obviate the need of such a procedure, while organization of the clot quickly renders chances of its success remote.

Schepelmann (190) was the first to report an operation in the treatment of this condition and he performed a phlebotomy with removal of the clots. Bazy reported rapid recovery of his patient following a similar procedure 9 days after the onset. Biebl and Henningsen were not able to extract all the clot from the veins of their patients.

Exploration with or without venolysis. To discover and remove an extravascular obstruction must be the main incentive to the surgeon. Yet the results of exploration have not been particularly encouraging. This is not surprising; the axillary vein is not difficult to expose but the subclavian vein is relatively inaccessible; indeed it is doubtful whether the first and second parts of the latter vein have ever been satisfactorily explored in this condition.

Ljunggren, Loehr, and Puhl reported good results following exploration of the axillary vein and the removal of constricting bands of fascia. Wulsten (220) believed that the vein was compressed by a thickened Langer's arch which he removed. Zschau found the subclavian vein constricted at the level of the first rib and the patient improved after venolysis. Moure and Martin (143) operating 2 months after a recurrence found bruising of the inner border of the coracobrachialis muscle, and following evacuation of a serous exudate the patient was able to return to work in 3 weeks. Zinninger found a thrombus within the axillary vein of Mont Reid's case and closed the wound without drainage, following which the patient recovered rapidly (168). Fievez and Broca had similar experiences, but others have been less successful.

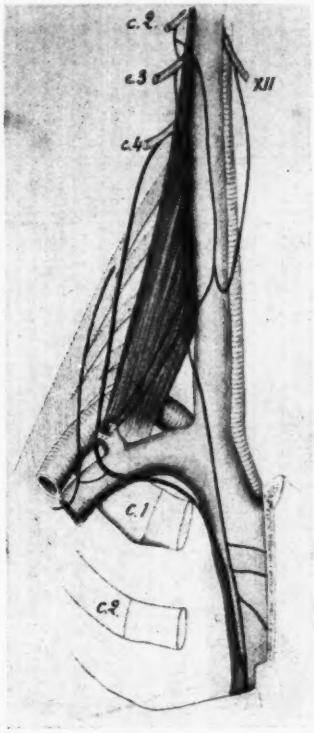

Fig. 24c

Fig. 24. Further examples of prevenous phrenic nerves (Hovelacque, Monod, Evrard, and Beuzart [87]). (*Annales d'Anatomie Pathologique.*)

Scalenotomy. Division of the scalenus anterior widens the costoclavicular interval and hence removes a possible extravascular obstruction. McLaughlin and Popma and Neij are the only authors to report such an operation and both obtained good results.

Excision of a venous segment. This operation is designed to eradicate a "focus of irritation" which is said to exist in the vein or in the perivenous tissues and which is responsible for impulses exerting a baneful effect locally and more peripherally. Many satisfactory results have been attributed to this procedure, but equally as good progress has been made by those receiving no

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
1	Paget	1875	M	50	R	No obvious cause	Gradual	Swelling	Heavy: weak	No special treatment	5 yrs.	Recovery
2	Paget	1875	M	27	R	No obvious cause	Gradual	Swelling	Heavy: numb	No special treatment	1 mo.	Apparent recovery
3	Schroetter	1884	M	42	R	Painter: was working	Sudden	Swelling	Discoloration	No special treatment	—	Functional recovery
4	Lahaussois	1910	M	23	R	Soldier: injured elbow by fall from horse	Gradual	Swelling	Distended veins	No special treatment	3 mos.	Functional recovery
5	Schepelmann	1910	M	22	L	Strained arm controlling wild horses. Mitral value disease and bradycardia	Gradual	Pain	Swelling: distended veins	Operation. Phlebotomy and removal of clot	5 wks.	Recovery
6	Heinecke	1911	M	27	R	Miller: was working	Sudden	Pain	Swelling	No special treatment	15 days	Recovery
7	Heinecke	1911	M	30	R	Cook: was "beating" meat	Sudden	Swelling	—	No special treatment	—	Recurrence with work
8	Heinecke	1911	M	41	R	Lifting heavy weight	Sudden	Pain	Swelling	No special treatment	—	—
9	Ruge	1911	M	34	R	Solicitor: No obvious cause	Sudden	Pain	Swelling: discoloration	No special treatment	5 mos.	Improved
10	Unger	1911	M	35	L	Laborer: No obvious cause	Gradual	Weakness	Swelling: distended veins	No special treatment	5 wks.	Improved
11	Rosenthal	1912	F	23	R	Housewife: No obvious cause	Gradual	Pain	Weakness: swelling: distended veins	No special treatment	4 mos.	Disability
12	Rosenthal	1912	F	11	R	After playing with a ball: no severe exertion	Gradual	Swelling	—	No special treatment	—	Recovery
13	Baum	1913	F	54	R	Unaccustomed effort: lifting heavy weights	Gradual	Pain	Swelling: discoloration: distended veins	No special treatment	1½ yrs.	Partial disability
14	Broca	1913	F	25	R	Domestic: onset during light work	Sudden	Pain	Swelling: "paralysis"	Operation	10 yrs.	Recovery
15	Delbet	1913	M	45	L	Arresting a person. No unusual movement	Sudden	Pain	Discoloration: swelling: W.R. +ve.	Operation. Excision venous segment	—	Recovery
16	Gautier	1913	M	49	R	No obvious cause	Gradual	Pain	Discoloration: swelling:	No special treatment	1 week	Recovery
17	Gautier	1913	M	72	L	No obvious cause	Gradual	Swelling	W.R. +ve.	Oper. Punctures of forearm	6 wks.	Improving
18	Langlet and Humbert	1913	M	23	R	Glazier: made a clumsy movement	Sudden	Fullness	Swelling	No special treatment	—	Recovery
19	Mouchet	1913	M	30	R	Lifting a piano	Sudden	Pain	Swelling: heaviness	No special treatment	25 days	Improving
20	Mouchet	1913	M	44	R	Mechanic: heavy work	Awoke	Swelling	Distended veins: W.R.+ve.	No special treatment	1 mo.	Improving
21	Pellot	1913	M	21	R	No obvious cause	Gradual	Swelling	—	No special treatment	25 days	Recovery
22	Potherat	1913	F	17	R	No obvious cause	Sudden	Swelling	Distended veins: discoloration: "paralysis"	No special treatment	11 mos.	Recovery
23	Potherat	1913	M	21	R	No obvious cause	Gradual	Swelling	Discoloration	No special treatment	4 mos.	Functional recovery
24	Rochard	1913	M	54	R	No obvious cause	Sudden	Swelling	—	No special treatment	3 mos.	Improving
25	Routier	1913	M	52	L	Fell 8 months previously No obvious cause	Sudden	"Paralysis"	Swelling: W.R. +ve.	No special treatment	—	Partial disability
26	Schwartz	1913	M	—	R	Porter: unloading very heavy parcel	Sudden	Pain	Discoloration: swelling	Operation. Excision venous segment	—	Recovery

27	Vossenaar	1913	M	—	R	Lifted 80 kilograms	Sudden	"Snap"	Heaviness: fatigue: swelling: discoloration	No special treatment	18 mos.	Partial disability
28	Chutro	1914	M	53	R	Intoxicated and fell asleep in clothes	? Awoke	Swelling	Distended veins	No special treatment	1 mo.	Partial recovery
29	Girard	1914	M	—	L	Engaged in heavy manual labor	Sudden	Swelling	Distended veins	No special treatment	—	—
30	Pellot	1916	M	—	R	No obvious cause	Gradual	Swelling	Distended veins	No special treatment	4 weeks	Recovery
31	Murard	1918	M	24	R	Engineer: heavy work for 15 days	Gradual	Fatigue	Distended veins: heaviness: swelling: "paralysis"	No special treatment	6 weeks	Recovery
32	Willan	1918	M	22	R	Excessive alcohol for 2 weeks	Awoke	Swelling	Discoloration: heaviness	No special treatment	2½ yrs.	Partial disability
33	Willan	1918	M	21	R	Washing after strenuous boat pulling exercise	Sudden	Pain	Swelling: discoloration	No special treatment	9 mos.	Apparent recovery: killed in action
34	Willan	1918	M	32	R	No obvious cause	Gradual	Pain	Weakness: numbness: swelling: discoloration	No special treatment	4 yrs.	Partial disability
35	Cadenat	1920	M	24	L	Onset 24 days after bullet wound of left chest	Gradual	Swelling	Pallor: "paralysis"	No special treatment	2 weeks	Improving
36	Cadenat	1920	M	44	R	Onset 15 days after severe blow of right chest	Gradual	Pain	Swelling: discoloration distended veins	No special treatment	4 weeks	Improving
37	Fievez	1921	M	37	L	Sharp movement of arm	Sudden	Pain	Swelling: discoloration	Operation. Exploration and venolysis	2 weeks	Recovery
38	Pavlovsky	1921	M	26	R	Punched on right shoulder	Gradual	Tightness	Swelling: pain	No special treatment	—	Improving
39	Pavlovsky	1921	M	23	R	No obvious cause	Gradual	Swelling	Discoloration	No special treatment	15 days	Recovery
40	Pavlovsky	1921	M	17	L	Butcher: Lifted a carcase but not unusual effort	Sudden	Pain	Swelling	No special treatment	16 days	Recovery
41	Wilson	1922	M	25	R	No obvious cause	Awoke	Swelling	"Paralysis"	No special treatment	—	Death from miliary tuberculosis
42	Wilson	1922	M	22	—	No obvious cause	Awoke	Swelling	"Paralysis": pain	No special treatment	6 mos.	Improving
43	Guyott and Jeanneney	1923	F	40	L	Lifting registers	Sudden	Pain	Heaviness: discoloration: swelling	Operation. Excision venous segment	7 mos.	Recovery
44	Ivanissevitch	1923	F	30	R	No obvious cause	Gradual	Swelling	Discoloration	No special treatment	2 years	Partial disability
45	Ivanissevitch	1923	M	53	R	Very mild effort	Sudden	Pain	Heaviness: swelling	No special treatment	1 wk.	Recovery
46	Grimault and Dantlo	1924	M	45	R	Miner: lifted a wagon	Sudden	Pain	Swelling: discoloration	Operation. Excision venous segment	4 mos.	Partial disability
47	Michelet and Mathieu	1924	F	22	L	No obvious cause	Awoke	Swelling	Tightness: discoloration	No special treatment	5 mos.	Partial recovery
48	Langeron and Ambroisine	1925	M	57	R	Wheeling heavy barrow	Sudden	Heaviness	Swelling: stiffness	—	—	—
49	Winterstein	1925	M	37	L	Taylor: Lifting heavy weights	Gradual	Pain	Swelling: discoloration	No special treatment	2½ yrs.	Improved
50	Winterstein	1925	M	48	R	Carpenter: also had substernal goiter	Awoke	Pain	Swelling: discoloration	No special treatment	—	Improved
51	Winterstein	1925	M	—	L	Weaver: used L. arm more than R.	Gradual	Tightness	Stiffness: swelling: pain	No special treatment	3 mos.	Improved

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY—Continued

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
52	Winterstein	1925	F	35	R	Fell and hurt right elbow	Gradual	Swelling	Pain: discoloration	No special treatment	—	—
53	Bazy	1926	M	27	R	Vigorous work	Gradual	Swelling	—	Operation. Phlebotomy and removal of clot	1 mo.	Recovery
54	Finkelstein	1927	F	24	L	Metal worker: no obvious cause	Gradual	Discoloration	Distended veins: swelling: pain	No special treatment	3 mos.	Improving
55	Finkelstein	1927	M	33	R	Sportsman: vigorous exercises	Gradual	Pain	Swelling: distended veins	No special treatment	5 mos.	Improving
56	Hartmann	1927	M	39	R	Pushing bed, exerted extra strength when bed hit object	Sudden	Pain	Heaviness: "paralysis": swelling	No special treatment	3 mos.	Recovery
57	Gould and Patey	1928	M	24	L	Golf player	Gradual	Pain	Numbness: swelling	No special treatment	13 yrs.	Recovery
58	Gould and Patey	1928	M	28	R	No obvious cause	Gradual	Pain	Swelling	No special treatment	1 mo.	Partial recovery
59	Gould and Patey	1928	M	24	R	Recurrent sore throats. Used electrical cutting machine	Sudden	Swelling	Discoloration: pain	No special treatment	5½ yrs.	Partial disability
60	Gould and Patey	1928	M	40	R	Hammering	—	Swelling	Weakness: pain	No special treatment	4 yrs.	Partial disability
61	Gould and Patey	1928	M	38	R	Screws inserted in wall above head	Gradual	Discoloration	Swelling: stiffness: pain	No special treatment	5 yrs.	Partial disability
62	Gould and Patey	1928	M	28	R	Placed jars on shelf above head	Gradual	Distended veins	Swelling: pain	No special treatment	5 mos.	Partial recovery
63	Gould and Patey	1928	M	27	R	Window cleaner: was cleaning ceiling	Sudden	Pain	Swelling	No special treatment	—	Partial disability
64	Gould and Patey	1928	M	23	R	Heavy work: sustained abrasions right hand	—	Pain	Swelling	No special treatment	6 mos.	Partial recovery
65	Leriche	1928	M	28	R	No obvious cause	Gradual	Swelling	Fatigue	No special treatment	8 days	Recovery
66	Loehr	1929	F	37	L	Washing clothes	Gradual	Swelling	Discoloration: distended veins: pain	Operation. Lymph glands removed	2 mos.	Recovery
67	Loehr	1929	F	33	R	No obvious cause	Gradual	Swelling	Distended veins: discoloration	No special treatment	2 yrs.	Partial disability
68	Loehr	1929	F	22	L	No obvious cause	Gradual	Fatigue	Distended veins: swelling	No special treatment	—	—
69	Loehr	1929	M	20	L	No obvious cause	Gradual	Swelling	Distended veins: discoloration	No special treatment	3 wks.	Recovery
70	Loehr	1929	M	20	R	Was lifting 40 pound weights	Sudden	Pain	Swelling: discoloration	No special treatment	—	Disability
71	Loehr	1929	M	38	L	Right femoral venous thrombosis previously. No obvious cause	Gradual	Swelling	Distended veins	No special treatment	—	—
72	Rocher	1929	M	24	R	No obvious cause	Awoke	Swelling	Distended veins	No special treatment	—	Partial recovery
73	Rocher	1929	F	21	L	No obvious cause	Awoke	Swelling	Distended veins	No special treatment	—	Partial recovery
74	Thomsen	1929	M	24	L							

75	Axford	1930	M	24	R	Carried bags of wood on right shoulder	Gradual	Swelling	—	No special treatment	1 mo.	Apparent recovery
76	Kinzel	1930	M	23	R	Epileptic	Gradual	Pain	Swelling: discoloration	Operation. Exploration only	4 wks.	Apparent recovery
77	Kinzel	1930	M	26	R	Teacher. Heavy lifting 4 days before	Sudden	Pain	Swelling: distended veins	No special treatment	—	Gradual recovery
78	Kinzel	1930	M	20	R	Laborer. Heavy work day previously	Awoke	Swelling	Distended veins	No special treatment	—	Gradual recovery
79	Kinzel	1930	M	48	L	Bricklayer. Influenza 10 days before	—	Swelling	Distended veins	No special treatment	—	Gradual recovery
80	Loubat and Carles	1930	M	34	R	Sharp blow on outer side arm one day before	Awoke	Swelling	Distended veins	No special treatment	10 days	Improving
81	Oehme	1930	M	—	L	Student: performing gymnastics	Gradual	Swelling	Discoloration: paraesthesia	No special treatment	6 days	Improving
82	Oehme	1930	M	22	R	Aortic regurgitation. No obvious cause	Gradual	Pain	Swelling: distended veins	No special treatment	9 mos.	Partial recovery
83	Oehme	1930	F	—	R	Receiving treatment for skin disease	Gradual	Swelling	Discoloration: distended veins	No special treatment	—	Improved
84	Clute	1931	F	21	R	5 months previously in car accident. No other possible cause	Gradual	Pain	Fatigue: discoloration: swelling	No special treatment	11 mos.	Partial disability
85	Clute	1931	F	42	L	Took vigorous exercises throwing arms above head	?Awoke	Discoloration	Swelling: pain: distended veins	No special treatment	12 mos.	Partial disability
86	Goudsmit	1931	F	38	L	No obvious cause	?Awoke	Heaviness	Discoloration	No special treatment	2 mos.	Improved
87	Goudsmit	1931	F	29	R	No obvious cause	Gradual	Swelling	Discoloration	No special treatment	3 mos.	Partial recovery
88	Horton	1931	M	—	—	Dug hole for post with a crowbar	Gradual	Pain	Tightness: swelling	No special treatment	3¼ yrs.	Recovery
89	Jakóbson	1931	M	29	R	Influenza	Gradual	Discoloration	Swelling: pain	No special treatment		
90	Jockisch	1931	M	23	L	Laboratory worker. No obvious cause	Gradual	Discomfort	Swelling: discoloration	No special treatment	10 weeks	Improved
91	Jockisch	1931	M	40	R	Painter, was working	Gradual	Swelling	Pain: discoloration	No special treatment	12 wks.	Partial disability
92	Jockisch	1931	M	26	L	No obvious cause	Gradual	Swelling	Pain: discoloration	No special treatment	—	—
93	Jockisch	1931	F	29	R	Housewife. No obvious cause	Gradual	Swelling	Pain: discoloration	No special treatment	—	—
94	Lenormant and Mondor	1931	M	20	R	Painter: working with arms elevated	Gradual	Pain	Heaviness: swelling	No special treatment	2 mos.	Persistent swelling
95	Lenormant and Mondor	1931	M	68	L	Lifting weights	Gradual	Pain	Fatigue: swelling	Operation. Excision venous segment	3 wks.	Improved
96	Ploetz	1931	M	28	R	Was boxing	Sudden	Pain	Fatigue: swelling	Operation. Exploration only	2 yrs.	Partial disability
97	Wulsten	1931	F	17	L	Domestic: prolonged heavy work	Gradual	Swelling	Discoloration	Operation. Division of thickened Langar's arch	1 mo.	Partial recovery
98	Alivisatos and Alivisatos	1932	M	27	R	Vaccinated 15 days before	Gradual	Heaviness	Fatigue: swelling: distended veins	No special treatment	6 mos.	Recovery
99	Anglesio	1932	M	25	L	No obvious cause	—	Pain	Swelling	No special treatment	2 mos.	Recovery

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY—Continued

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
100	Arkema	1932	M	22	R	Lifted sack of charcoal	Sudden	Pain	Swelling: discoloration	No special treatment	5 mos.	Improving
101	Chifoliau and Folliasson	1932	M	38	R	Furuncle on shoulder several days before	Gradual	Swelling	Pain: discoloration	Operation. Excision venous segment	3 mos.	Recovery
102	Cottalorda	1932	M	27	R	Lifted a 100 kgm. weight	Sudden	Swelling	Pain	Operation. Excision venous segment and periarterial sympathectomy	1 mo.	Recovery
103	Cottalorda	1932	M	47	R	Strenuous pushing	Sudden	Pain	Swelling	No special treatment	18 mos.	Disability
104	Firth and Mackay	1932	F	19	R L	Stirring heavy pudding No obvious cause	Gradual Gradual	Pain Pain	Swelling: discoloration Swelling: discoloration	No special treatment No special treatment	51 mos. 2 mos.	Partial recovery Improving
105	Moure and Martin	1932	M	21	R	Intoxicated the night before	Awoke	Swelling	Pain: "paralysis"	Operation. Exploration only	3 mos.	Recovery
106	Paggi	1932	M	28	R	Overtime work as iron-smith	Gradual	Swelling	Distended veins	No special treatment	—	Recovery
107	Pinelli	1932	M	46	L	A bell-ringer	Gradual	Swelling	Pain: heaviness	No special treatment	—	—
108	Thomsen	1932	F	37	L	Conservator: mild injury	Gradual	Pain	Swelling: discoloration	No special treatment	—	Partial recovery
109	Fettes	1933	F	40	R	Carved for nine people day previously	Awoke	Swelling	Discoloration	No special treatment	18 mos.	Recovery
110	Huard and Lenormant	1933	M	38	L	No obvious cause	Gradual	Swelling	—	Operation. Excision venous segment and periarterial sympathectomy	—	Improved
111	James	1933	M	26	L	No obvious cause	Gradual	Swelling	Pain: distended veins	No special treatment	12 yrs.	Recovery
112	Lapeyre	1933	M	35	R	Violent exertion	Gradual	Swelling	Discoloration	Operation. Excision venous segment	1 mo.	Apparent recovery
113	Lapeyre	1933	M	14	R	Carried heavy pail of water	—	—	—	—	—	—
114	Loehr	1933	M	23	R	Rivetting	Gradual	Tightness	Discoloration: swelling	Operation. Exploration and venolysis	2 mos.	Improving
115	Loehr	1933	M	29	L	No obvious cause	Awoke	Swelling	Tightness: discoloration	Operation. Exploration and venolysis	—	Recovery
116	Loehr	1933	M	18	L	Attended riding and driving lessons	Gradual	Swelling	Discoloration: pain	Operation. Exploration and venolysis	—	—
117	McGoogan and Simmons	1933	F	42	L	Toxemia of pregnancy. Lifted herself in bed	Sudden	Swelling	Pain: "paralysis": distended veins	No special treatment	2 yrs.	Partial disability
118	McIntosh	1933	M	—	L	Polished gun barrels	Gradual	Swelling	Discoloration: distended veins	No special treatment	1 mo.	Recovery
119	Ross	1933	M	27	R	No obvious cause	Awoke	Heaviness	Swelling: discoloration	No special treatment	—	Partial disability
120	Selim	1933	M	36	R L	Daily exercise No obvious cause	Sudden Gradual	Pain Swelling	Distended veins. Discoloration: distended veins	No special treatment No special treatment	10 wks. 4 wks.	Recovery Recovery
121	Taylor	1933	M	19	L	No obvious cause	Awoke	Swelling	Discoloration	No special treatment	6¼ yrs.	Recovery

122	Areta	1934	M	29	R	Baker: Shut door of furnace	Sudden	Discomfort	Swelling: discoloration: distended veins	No special treatment	6 mos.	Improved
123	Demel and Sgalitzer	1934	M	—	L	No obvious cause	Sudden	Swelling	Paresthesia	No special treatment	3 yrs.	Partial disability
124	Demel and Sgalitzer	1934	M	—	R	Soldier: strained right arm whilst at work	Gradual	—	Swelling: pain	No special treatment	6 mos.	Partial disability
125	Esau	1934	M	20	L	Carried heavy weights	Gradual	Swelling	Pain	No special treatment	8 mos.	Improved
126	Forster	1934	M	41	R	No obvious cause	Gradual	Swelling	—	No special treatment	4 mos.	Partial recovery
127	Gerster	1934	M	23	R	Venesection left arm 3 weeks before. No obvious cause	Gradual	Swelling	Pain	No special treatment	18 mos.	Partial disability
128	Matas	1934	M	26	R	Sprained arm	Sudden	Pain	Swelling: discoloration	No special treatment	4 yrs.	Partial disability
129	Matas	1934	M	21	R	Strained arm	Sudden	Swelling	Pain	No special treatment	12 yrs.	Partial disability
130	Piccagli	1934	M	21	R	Over-worked his arm on a lever	Gradual	Swelling	Distension of veins discoloration	No special treatment	1 yr.	Recovery
131	Reid	1934	M	63	L	Furuncles left forearm prior to onset	Awoke	Swelling				
132	Ballon	1935	M	22	R	Had sepsis opposite arm	Gradual	Swelling	—	No special treatment	9 mos.	Partial disability
133	Barker	1935	M	23	R	Exercising in gymnasium. No obvious cause	Gradual	Swelling	Discoloration: pain: distended veins	No special treatment	4 days	Improving
134	Barker	1935	M	36	R	Dredge operator. Right arm forced backwards	Gradual	Pain	Swelling: discoloration	No special treatment	5 yrs.	Partial disability
135	Barker	1935	M	59	R	Drunkard	Gradual	Pain	Swelling: distended veins	No special treatment	—	—
136	Barker	1935	M	27	L	Pitched hay 3 days before	Gradual	Swelling	Distended veins: recurrence	No special treatment	1 yr.	Partial disability
137	Barker	1935	M	59	L	Exercising in gymnasium	Sudden	Swelling	Discoloration: distended veins	No special treatment	1 yr.	Functional recovery
138	Barker	1935	F	22	R	Fractured R. clavicle 9 years before. Played tennis	Gradual	Weakness	Discolation: swelling	No special treatment	4 yrs.	Partial disability
139	Belilios and Houghton	1935	M	24	R L	No obvious cause No obvious cause	Gradual Sudden	Tightness Swelling	Swelling: discoloration Stiffness: discolaration	No special treatment No special treatment		Partial disability
140	Busatti	1935	M	24	L	Lifted bricks from ground to level of 6 ft.	Gradual	Pain	Swelling: discoloration	No special treatment	—	—
141	Chapman	1935	M	19	R	Lifted cement block	Gradual	Swelling	—	—	—	—
142	Delarue and Contiades	1935	M	32	R	Severe blow on elbow 2 days before	Gradual	Swelling	—	Operation. Excision venous segment		Improving
143	Kilgore	1935	—	—	—	Minor blow on upper arm	Sudden	Swelling	Distended veins	—	—	Partial disability
144	Kux	1935	M	29	R	Blow on Right arm some days previously	Gradual	Weakness	Swelling: pain	No special treatment	1½ yrs.	Improved
145	Kux	1935	M	24	L R	Gunner. Heavy work No obvious cause	Gradual Gradual	Weakness Tightness	Pain: swelling Swelling	No special treatment No special treatment	18 mos. 7 mos.	Improved Improved
146	Kux	1935	M	24	R L	Thatcher. Heavy work No obvious cause	Gradual Gradual	Pain Pain	Swelling Swelling	No special treatment No special treatment	6 wks. 1 wk.	Improved

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY—Continued

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
147	Ljunggren	1935	M	24	R	Strenuous work at saw mill	Gradual	Swelling	Discoloration: distended veins: "paralysis": heaviness	Operation: exploration and venolysis	22 mos.	Improved
148	McClanahan	1935	M	17	R	Pitching soya beans	Sudden	Pain	Heaviness: swelling	No special treatment	4½ mos.	Partial disability
149	Rixford	1935	F	45	R	Cleaned floor with right arm. Heavy pick-work in garden	Sudden	Tightness	Swelling: pain	No special treatment	6 yrs.	Partial disability
150	Rixford	1935	M	22	R	Lifting box of 60–100 pound weight	Sudden	Pain	Swelling: discoloration	No special treatment	6 mos.	Partial disability
151	Rixford	1935	M	40	R	Working overtime. Swung 25 lb. cooper's hook	Sudden	"Snap"	Swelling: discoloration	No special treatment	—	—
152	Rixford	1935	M	40	R	Broke 6 ft. fall by hooking arm over timber	—	—	—	No special treatment	10 mos.	Partial recovery
153	Salmon and Audier	1935	M	70	L	Sawing wood	Sudden	Pain	Numbness: swelling: discoloration	No special treatment	—	Recovery
154	Veal and McFetridge	1935	M	19	R	Slept with arm above head	Awoke	Pain	Swelling	No special treatment	2 wks.	Recovery
155	Veal and McFetridge	1935	F	15	R	No obvious cause	—	Pain	Swelling	No special treatment	7 yrs.	Functional recovery
156	Herbrand	1936	M	20	R	Received blow on right elbow	Gradual	Swelling	Pain: discoloration	Operation: Excision of venous segment	3½ mos.	Improving
157	Oldfield and Pyrah	1936	M	20	R	No obvious cause	Awoke	Swelling	Stiffness	No special treatment	10 mos.	Swelling persisted
158	Cruickshank	1937	M	24	L	Fell from horse and struck left shoulder on its head	Sudden	Pain	Weakness	No special treatment	—	—
159	De Takats	1937	M	25	R	Grinding spark plugs of car	Sudden	Pain	Swelling: discoloration	Operation. Perivenous sympathectomy	3¼ yrs.	Functional recovery
160	Finlay	1937	F	52	R	No obvious cause	Awoke	Swelling	Tenderness	No special treatment	—	Recovery
161	Gottesman and Beller	1937	—	—	L		Gradual	Pain	Stiffness: swelling	Operation. Exploration only	6 wks.	Partial recovery
162	Kaplan and Katz	1937	M	24	R	Clothes presser. No obvious cause	Gradual	Discoloration	Swelling: distended veins	No special treatment	1 mo.	—
163	Laewen	1937	M	49	R	No obvious cause	Gradual	Pain	Swelling	Operation. Excision venous segment	2 mos.	Improved
164	Patel and Morel-Fatio	1937	M	17	R	Received blow on right shoulder 12 days before	Gradual	Pain	Swelling: distended veins	Operation. Excision venous segment	9 days	Recovery
165	Puehl	1937	M	59	L	Lifting corn sacks, 150 pounds in weight	Sudden	Pain	Swelling	Operation. Exploration and venolysis	4 mos.	Improving
166	Puehl	1937	M	26	R	No obvious cause	Gradual	Swelling	Distended veins: pain	Operation. Exploration and venolysis	3 mos.	Improving
167	Goldberg and Foley	1938	M	32	L	Upper respiratory tract infection. No obvious cause	Gradual	Discomfort	Swelling	No special treatment	14 mos.	Recovery

168	Harms	1938	M	29	R	Carried heavy sugar bags	Sudden	Pain	Swelling: discoloration	No special treatment	2¼ yrs.	Partial recovery
169	Harms	1938	M	22	R	Telegraph employee: was working	Gradual	Distended veins	Pain: heaviness	No special treatment	3 yrs.	Partial disability
170	Kaplan	1938	M	42	L	Fell and injured left hand	Sudden	Swelling		No special treatment		
171	Kaplan	1938	M	40	R	Lifted a cake of ice	Sudden	Pain	Stiffness: swelling: coldness of hand	No special treatment		
172	Kaplan	1938	M	37	L	Lifted heavy weight	Sudden	Pain	Swelling: discoloration	No special treatment		Partial disability
173	Kaplan	1938	M	25	R	Pitching a ball	Gradual	Pain	Swelling: discoloration	No special treatment		Partial disability
174	Mason	1938	M	21	R	Baseball pitcher. Occupation entailed strenuous pulling on cables	Gradual	Pain	Swelling: recurrence	No special treatment	18 mos.	Partial disability
175	Rieder	1938	M	20	R	No obvious cause	? Awoke	Swelling	Discoloration	Paravertebral Sympathetic Injection	—	Recovery
176	Wagner	1938	M	20	R	Bricklayer: No obvious cause	Gradual	Swelling	Heaviness· pain	No special treatment	1 mo.	Improving
177	Wagner	1938	M	25	L	Lifted heavy buckets	Gradual	Swelling	Distended veins	Operation: Excision venous segment	—	Improving
178	Wagner	1938	M	40	R	Shopkeeper: rowing during holidays	Sudden	Pain	Swelling: discoloration	No special treatment	6 wks.	Improving
179	Wagner	1938	F	46	L	Nursing sister: was carrying heavy case	Sudden	Pain	Swelling	No special treatment	7 wks.	Recovered
180	Wagner	1938	M	—	R	Surgeon: was shaving	Sudden	Discomfort	Swelling: discoloration	No special treatment	2 yrs.	Partial recovery
181	Zehnder	1938	M	30	L	Doctor: no obvious cause	Awoke	Swelling	Pain: discoloration	No special treatment	2 mos.	Improved
182	Zehnder	1938	M	57	L	Printer: heavy work	Gradual	Swelling	Discoloration: distended veins	No special treatment	4 wks.	Improved
183	Zehnder	1938	M	21	L	Soldier: heavy work	? Awoke	Swelling	Weakness: pain	No special treatment	4 wks.	Improved
184	Zehnder	1938	F	32	R	Domestic servant: No obvious cause	Gradual	Swelling	Discoloration: pain: distended veins	No special treatment	5 mos.	Partial recovery
185	Zehnder	1938	M	32	R	Cooper: No obvious cause	Gradual	Swelling	Distended veins. W.R..+ve.	No special treatment	3 mos.	Improved
186	Zehnder	1938	M	36	L	Carrier: Scratched elbow complicated by olecranon bursitis	Gradual	Swelling	Discoloration	No special treatment	3 mos.	Improved
187	Zehnder	1938	M	51	R	Forger: Injury to right arm	Gradual	Swelling	Distended veins	No special treatment	5 mos.	Improved
188	Zehnder	1938	M	46	R	Tuberculosis sufferer	Gradual	Swelling	Pain: discoloration	Operation. Perivenous sympathectomy	1 mo.	Improving
189	Zschau	1938	M	45	R	Onset followed a brawl	Gradual	Swelling	Pain: distended veins	No special treatment	—	—
190	Zschau	1938	M	42	R	No obvious cause	Gradual	Swelling	Pain: distended veins	Operation. Exploration and venolysis	—	Recovery
191	Biebl	1939	M	24	R	No obvious cause	Gradual	Swelling	Discoloration	Operation. Venolysis, phlebotomy: removal of thrombus	—	Recovery
192	Herlyn	1939	M	21	L	Porter: Placed bag on Luggage rack	Sudden	Swelling	Pain: discoloration	Operation. Exploration only	6 wks.	Improving

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY—Continued

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
193	Herlyn	1939	M	30	R	Turner: Long hours of work	Gradual	Swelling	Discoloration	No special treatment	25 yrs.	Partial recovery
194	Herlyn	1939	F	44	L	No obvious cause	Gradual	Discomfort	Swelling: discoloration	No special treatment	10 yrs.	Partial recovery
195	Herlyn	1939	M	26	R	No obvious cause	Gradual	Swelling	Discoloration: distended veins	No special treatment	3 days	Improving
196	Herlyn	1939	M	30	L	Laborer	Gradual	Pain	Swelling	No special treatment	6 yrs.	Partial recovery
197	Herlyn	1939	M	24	R	No obvious cause	Gradual	Pain	Swelling: discoloration	Operation: Exploration only	4 yrs.	Partial recovery
198	Herlyn	1939	M	26	R	No obvious cause	Gradual	Swelling	Pain	No special treatment	1 yr.	Slight improvement
199	McLaughlin and Popma	1939	M	24	R	Heavy work, chopping wood	Sudden	Swelling	Discoloration: recurrence	Operation: Scalenotomy	16 mos.	Recovery
200	Majer	1939	M	31	R	No obvious cause	Gradual	Swelling	Pain: discoloration: "paralysis"	No special treatment	—	Partial recovery
201	Peutz	1939	M	33	L	No obvious cause	Awoke	Swelling	Discoloration "paralysis"	No special treatment	6 wks.	Recovery
202	Roelsen	1939	M	47	R	Working with lime	Sudden	Swelling	Discoloration: tightness: recurrence	Operation. Perivenous sympathectomy	2 mos.	Improving
203	Roelsen	1939	M	20	R	"Test of strength" with arm of friend	Gradual	Swelling	Discoloration: cold hand	Operation. Perivenous sympathectomy	6 mos.	Partial disability
204	Roelsen	1939	F	26	R	Was carrying bucket of water	Sudden	Swelling	Discoloration: fatigue	No special treatment	12 mos.	Partial disability
205	Roelsen	1939	F	28	R	Polished pieces of porcelain	Gradual	Swelling	Discoloration	No special treatment	12 mos.	Partial disability
206	Roelsen	1939	F	34	R	No obvious cause	Gradual	Pain	Weakness: swelling	No special treatment	6 wks.	Not improved
207	Roelsen	1939	F	23	R	No obvious cause	Awoke	Swelling	Distended veins	No special treatment	2 yrs.	Partial recovery
208	Roelsen	1939	F	22	L	Domestic. No obvious cause	Gradual	Distended veins	Swelling: pain	Operation. Exploration only	1 yr.	Partial disability
209	Henningsen	1940	F	27	R	Domestic. Vigorous cleaning	Gradual	Discoloration	Swelling: pain	Operation. Excision venous segment	—	Improved
210	Henningsen	1940	M	29	L	Soldier: no obvious cause	Gradual	Swelling	Distended veins: discoloration	Operation. Excision venous segment	—	Improved
211	Henningsen	1940	M	27	L	Crane driver. Heavy work turning handles	Sudden	Pain	Swelling: discoloration	Operation. Phlebotomy and removal of clots	—	Improved
212	Stover and Herrell	1940	M	66	R	Polycythemia. Carried pail of water	Gradual	Pain	Swelling	No special treatment	1 mo.	Partial recovery
213	Allin	1941	M	18	R	Swimming "crawl" stroke	Sudden	Pain	Discoloration: swelling: fatigue	No special treatment	2½ mos.	Partial recovery
214	Friedland and Farber	1941	M	23	L	No obvious cause	Gradual	Pain	Swelling	No special treatment	4 yrs.	Partial recovery
215	O'Regan	1941	M	39	R	Hauling load by hose slung over right shoulder	Sudden	"Snap"	Pain: swelling	No special treatment	17 mos.	Partial disability

216	O'Regan	1941	M	17	R	Carried fencing posts on right shoulder the day before	Gradual	Pain	Swelling	No special treatment	5 yrs.	Partial recovery
217	DeBakey Ochsner and Smith	1942	M	37	R	Sawing tree with arm above head	—	Swelling	Discoloration	Paravertebral Sympathetic Injection	1 yr.	Recovery
218	DeBakey Ochsner and Smith	1942	F	66	L	Hypertension. No other obvious cause	—	Pain	Swelling: stiffness	No special treatment	—	Improved
219	DeBakey Ochsner and Smith	1942	F	15	R	Beating time with baton	—	Swelling	Discoloration	Paravertebral sympathetic injection	3 mos.	Recovery
220	DeBakey Ochsner and Smith	1942	M	54	R	Saws wood. Attack of influenza	—	Swelling	Discoloration: pain	Paravertebral sympathetic injection	—	Improved
221	DeBakey Ochsner and Smith	1942	F	16	R	No obvious cause	—	Swelling	Discoloration: fatigue	Paravertebral sympathetic injection	1 mo.	Improved
222	Cohen	1942	M	27	R	Fractured right scapula 4 months before	Gradual	Discoloration	Swelling: pain	No special treatment	16 mos.	Partial disability
223	Greenfield	1942	F	20	R	Upper respiratory tract infection. No other cause	Gradual	Swelling	Tightness	No special treatment	5 mos.	Partial recovery
224	Hauge	1942	M	34	R	Heavy work with right arm	Awoke	Swelling	Discoloration: distended veins	Operation. Exploration only	6 mos.	Partial disability
225	Hauge	1942	F	22	L	Upper respiratory tract infection. No other obvious cause	Gradual	Swelling	Discoloration: stiffness: weakness	Operation. Exploration and venolysis	5 mos.	Not improved
226	Hauge	1942	M	21	L	Unaccustomed hard work	? Awoke	Swelling	Discoloration: tightness	No special treatment	2½ yrs.	Partial disability
227	Hoffert	1942	M	21	R	Baseballer. "Test of strength" with another	Gradual	Swelling	Pain	No special treatment	6 mos.	Recovery
228	Hoffert	1942	F	47	L	No obvious cause	Gradual	Discomfort	Pain	No special treatment	21 days	Recovery
229	Hoffert	1942	M	21	R	Pitching and curving a baseball	Gradual	Pain	Swelling: weakness	No special treatment	5 mos.	Partial disability
230	Kaplan	1942	F	62	R	Clipper of horses' hair. No obvious cause	Gradual	Swelling	Distended veins	No special treatment	26 yrs.	Partial disability
231	Kaplan	1942	M	27	L	Pushed and pulled heavy silk machine	Sudden	Pain	Swelling: discoloration	No special treatment	3 mos.	Partial recovery
232	Kaplan	1942	M	23	R	Lifted 60 pound can of milk	Sudden	Pain	Swelling: stiffness	No special treatment	3 mos.	Partial recovery
233	Keener, Canty and Prevost	1942	M	29	L	Diver: failed to inflate suit	Gradual	Swelling	Discoloration	No special treatment	2 mos.	Improving
234	Perlow and Barth	1942	M	16	R	Was sweeping	Sudden	Pain	Fatigue: swelling	No special treatment	6 mos.	Functional recovery
235	Perlow and Barth	1942	M	23	L	No obvious cause	Gradual	Distended veins	Fatigue	No special treatment	—	—
236	Pelner and Cohn	1942	M	17	R	Playing basket ball	Gradual	Swelling	Discoloration	No special treatment	5 yrs.	Partial recovery
237	Pelner and Cohn	1942	F	20	R	No obvious cause	Sudden	Swelling	Discoloration	No special treatment	9 mos.	Partial recovery
238	Pelner and Cohn	1942	M	23	R	Blow on right arm	Gradual	Pain	Swelling	No special treatment	2 days	—
239	Skogstad	1942	M	38	R	Performing unusual work	Gradual	Swelling	Pain: discoloration	No special treatment	2 yrs.	Partial disability

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY—Continued

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
240	Skogstad	1942	M	32	R	Lifted heavy suitcase above head	Sudden	Pain	Swelling: discoloration	No special treatment	1¾ yrs.	Partial disability
241	Hermodsson	1943	M	41	L	Farmer. Cervical rib	Gradual	Swelling	Pain: discoloration	No special treatment	—	—
242	Neij	1943	—	22	L	No obvious cause. Heavy work	—	—	—	Operation: Scalenotomy	—	Cured
243	Neij	1943	—	51	L	Over-use left arm	—	—	—	Operation. Exploration and venolysis	2½ yrs.	Improved
244	Neij	1943	—	19	L	Metal worker. Over-use left arm	—	—	—	No special treatment	—	—
245	Neij	1943	—	42	L R	Direct trauma	—	—	—	No special treatment	—	—
246	Neij	1943	—	22	R	Direct trauma	—	—	—	No special treatment	—	—
247	Neij	1943	—	28	R	"Abduction strain"	—	—	—	No special treatment	—	—
248	Neij	1943	—	27	L	"Abduction strain"	—	—	—	No special treatment	—	—
249	Sampson	1943	M	30	R	Tennis player and pitcher in baseball	Gradual	Swelling	Discoloration: distended veins	No special treatment	6 mos.	Partial recovery
250	Sampson	1943	F	62	L	Sinusitis: emphysema: bronchiectasis	Gradual	Swelling	Discoloration	No special treatment	12 mos.	Partial recovery
251	Sampson	1943	M	37	L	Dish-washer. No obvious cause	Gradual	Discoloration	Tightness: distended veins: swelling	No special treatment	16 days	Slight improvement
252	Sampson	1943	M	48	R	Housework. No obvious cause	Gradual	Swelling	Discoloration	No special treatment	4 mos.	Recovery
253	Sampson	1943	M	22	R	Sawing: planing: lifting wood	Gradual	Swelling	Discoloration: pain: distended veins	No special treatment	10 days	Recovery
254	Stabins	1943	M	23	L	Installing airplane motor involving work above level of head	Sudden	Stiffness	Numbness: discoloration: swelling	Operation. Excision venous segment	—	Recovery
255	Velasco, Acevedo, and Casanireva	1943	M	22	R	Heavy work day before. No other obvious cause	Gradual	Swelling	Discoloration: tightness	No special treatment	1 yr.	Improved
256	Velasco, Acevedo, and Casanireva	1943	M	20	R	Heavy work	Gradual	Heaviness	Swelling: discoloration	No special treatment	10 mos.	Partial recovery
257	Willcutts and Shelburne	1943	M	—	R	Breaking concrete with sledge hammer	Gradual	Swelling	Weakness: pain	No special treatment	9 mos.	Not improved
258	Willcutts and Shelburne	1943	M	—	R	Epileptic: Onset day after a fit	Gradual	Swelling	Numbness	Paravertebral Sympathetic Injection	1 mo.	Recovery
259	Bruce	1944	M	23	L	Vigorous work involving use of arms above level of head	Sudden	Swelling	Pain	Paravertebral Sympathetic Injection	3 mos.	Recovery

260	Ditter and Walker	1944	M	32	R	No obvious cause	Gradual	Fatigue	Pain: swelling	No special treatment	—	Improved
261	Ffrench	1944	M	22	L	Reached for objects from high shelves	Awoke	Swelling	Pain	No special treatment	—	—
262	Roelsen	1944	F	17	L	Window cleaning	Gradual	Swelling	Discoloration: recurrence	Operation. Excision venous segment	1 yr.	Partial recovery
263	Roelsen	1944	M	35	R	No obvious cause	Gradual	Pruritis	Swelling: discoloration: distended veins	Heparin	16 mos.	Partial recovery
264	Roelsen	1944	F	45	L	Lifts heavy rolls of cloth from shelves	Gradual	Swelling	Discoloration	No special treatment	6 mos.	Partial recovery
265	Roelsen	1944	F	42	L	Injured left shoulder two weeks before. Carried heavy potato sack.	Awoke	Swelling	Discoloration: tightness	Heparin	2 mos.	Partial recovery
266	Roelsen	1944	M	26	R	Saws and lifts heavy rolls of steel cable	Gradual	Heaviness	Tightness: pain	No special treatment	2 mos.	Partial disability
267	Roelsen	1944	M	23	R	Played basket ball: septic finger nails	Gradual	Fatigue	Swelling: pain	Heparin	4 mos.	Partial disability
268	Roelsen	1944	M	32	R	Gymnasium exercises. No obvious cause	Gradual	Discoloration	Distended veins: tightness: pain	No special treatment	2 mos.	Partial recovery
269	Samuel	1944	M	22	L	No obvious cause	Gradual	Swelling	Distended veins	No special treatment	2 yrs.	Partial recovery
270	Roca and Lazaroni	1945	M	20	R	Soldier at drill: struck right elbow	Sudden	Pain	Swelling: weakness	No special treatment	2½ mos.	Partial recovery
271	Roca and Lazaroni	1945	M	19	R	No obvious cause	Awoke	Pain	Swelling	No special treatment	3 wks.	Improved
272	MacCarthy	1946	F	35	L	Putting left arm into overcoat sleeve	Sudden	"Snap"	Swelling: weakness: tightness	Paravertebral Sympathetic Injection	—	Improved
273	Arden	1948	M	39	R	Upholsterer. No obvious cause	Gradual	Swelling	Discoloration: distended veins	Heparin, Dicumarol	5 wks.	Improved
274	Bedford	1948	M	41	L	Clergyman. No obvious cause	Gradual	Swelling	Numbness: discoloration: distended veins	No special treatment	1 mo.	Improved
275	Boyd	1948	M	19	R	No obvious cause	Awoke	Discomfort	Pain: swelling: discoloration	Heparin, Dicoumarin	11 days	Much improved
276	Carling	1948	F	38	L	No obvious cause	Gradual	Pain	Swelling: discoloration distended veins	No special treatment	5 mos.	Partial disability
277	Clark-Kennedy	1948	F	60	R	No obvious cause	Sudden	Swelling	Discoloration: distended veins: pain	No special treatment	3 wks.	Improving
278	Ellis	1948	M	21	L	Student: Had cough. No obvious cause	Gradual	Pain	Distended veins: swelling	No special treatment	3 wks.	Improving
279	Ellis	1948	F	30	R	Heavy housework two weeks previously	Sudden	Paresthesia	Pain: swelling: discoloration	No special treatment	5½ wks.	Improving
280	Evans	1948	M	23	L	Played squash one day previously (right-handed)	Gradual	Swelling	Discoloration: tightness: distended veins	No special treatment	10 days	Improved
281	Evans	1948	F	20	L	No obvious cause	Gradual	Swelling	Discoloration	No special treatment	3 mos.	Improved

TABLE I.—REVIEW OF 320 CASES OF VENOUS OBSTRUCTION IN THE UPPER EXTREMITY—Continued

No.	Author	Year	Sex	Age	Side	Cause	Onset	Initial Symptom	Chief Symptoms	Treatment	Follow Up	Result
282	Gould	1948	M	22	R	No obvious cause	Sudden	Swelling	Pain: discoloration: distended veins	No special treatment	1 wk.	Improving
283	Handley	1948	M	28	R	No obvious cause	Gradual	Distended veins	Pain: discoloration: stiffness	No special treatment	2½ wks.	Improving
284	Handley	1948	F	33	R	No obvious cause	Gradual	Swelling	Pain: distended veins	No special treatment	18 mos.	Partial disability
285	Handley	1948	M	18	L	"Ragging" with friends day previously	Awoke	Pain	Swelling: discoloration	No special treatment	2 wks.	Much improved
286	Hughes	1948	F	22	R	Cleaning floors. No unusual effort	Gradual	Discoloration	Swelling: pain: distended veins	No special treatment	25 yrs.	Partial disability
287	Hughes	1948	F	60	L	Housework: No obvious cause	Gradual	Discoloration	Swelling: pain	No special treatment	13 mos.	Partial recovery
288	Hughes	1948	M	36	R	Carried 2-3 cwt. meat on right shoulder	Sudden	Swelling	Discoloration	Heparin	22 mos.	Partial recovery
289	Hughes	1948	F	37	L	No obvious cause	Awoke	Swelling	Discoloration: pain	No special treatment	9 mos.	Partial disability
290	Hughes	1948	M	39	R	Cough one month before. Trapped in bombed building two weeks before	Gradual	Swelling	Discoloration: pain: distended veins	No special treatment	7 yrs.	Partial disability
291	Hunter	1948	F	17	R	Machinist: Dry cough for years	Gradual	Pain	Swelling: discoloration: distended veins	No special treatment	1 wk.	Improving
292	Hunter	1948	M	22	R	Grocer. No obvious cause	Gradual	Tightness	Discoloration: swelling: fatigue	No special treatment	3 wks.	Improving
293	Hunter	1948	F	60	L	Ex-nursing sister. Cough for 5 years	Sudden	Discoloration	Swelling: pain	No special treatment	10 days	Improved
294	Hunter	1948	M	37	R	Used right arm to turn machine	Gradual	Swelling	Pain: distended veins	No special treatment	2 mos.	Improved
295	Jensen	1948	M	24	R	Engaged in gymnastics. No obvious cause	Gradual	Swelling	Pain	Heparin	6 wks.	Recovery
296	Learmonth	1948	M	37	L	No obvious cause	Sudden	Pain	Swelling: distended veins	Heparin, Dicumarol	4 mos.	Improved
297	Learmonth	1948	M	34	R	Bullet wound right chest three days before. No other obvious cause	Gradual	Pain	Swelling: distended veins	No special treatment	10 wks.	Improved
298	Learmonth	1948	M	32	R	Lifting heavy cases: was pushing one forward and up	Sudden	"Snap"	Distended veins: swelling	Paravertebral Sympathetic Injection	5 wks.	Improved
299	Learmonth	1948	M	22	L	Lifting heavy propellors waist high	Gradual	Swelling	Pain: discoloration: distended veins	Paravertebral Sympathetic Injection	2½ mos.	Recovery
300	Learmonth	1948	F	45	R	Thyroidectomy 3 months before. No obvious cause	Gradual	Paresthesia	Swelling: discoloration: pain	Paravertebral Sympathetic Injection	18 mos.	Improved

301	Learmonth	1948	F	20	R	Unaccustomed exercise day previously	Awoke	Tightness	Discoloration: swelling, distended veins	Paravertebral Sympathetic Injection, Heparin	1 mo.	Improved
302	Learmonth	1948	F	22	R	Injured left arm 2 months before and so used right arm more than left	Gradual	Swelling	Numbness: discoloration	Paravertebral Sympathetic Injection, Sympathectomy Heparin	—	Improving
303	McEvedy	1948	M	41	L	Sheet-metal worker: Left arm abducted at work	Gradual	Swelling	Discoloration	No special treatment	4 mos.	Partial recovery
304	McEvedy	1948	F	41	L	Shop assistant: 2 weeks before sudden pull on arm on alighting from bus	Gradual	Swelling	Pain: discomfort	No special treatment	9 mos.	Partial recovery
305	McEvedy	1948	M	39	R	Fitter: No obvious cause	—	—	Swelling: discoloration: distended veins	No special treatment	13 yrs.	Partial disability
306	Morton	1948	M	58	L	Shipyard welder: Over-use of arm at work	Gradual	Fatigue	Distended veins: swelling: pain	Dicoumarin	3½ mos.	Functional recovery
307	Morton	1948	M	59	L	Hauling heavy weights up side of building with rope and pulley	Awoke	Swelling	Pain: stiffness: discoloration	Dicoumarin	2 mos.	Functional recovery
308	Morton	1948	M	19	R	House painting: much abduction of arm	? Awoke	Swelling	Discoloration: pain: stiffness	Dicoumarin	2½mos.	Functional recovery
309	Morton	1948	M	24	R	Engaged in gymnastics	Sudden	Pain	Swelling: discoloration: tightness	Dicoumarin	1½ mos.	Partial recovery
310	Telford	1948	M	22	L	Lifting heavy rods at work	Gradual	Swelling	—	No special treatment	—	—
311	Telford	1948	M	17	R	Washing himself. No other obvious cause	Sudden	Tightness	Swelling: distended veins: discoloration	No special treatment	21 mos.	Partial disability
312	Telford	1948	M	49	L	Lifting cloth at work	Gradual	Swelling	Distended veins: W.R. +ve.	No special treatment	16 mos.	Partial recovery
313	Telford	1948	M	27	L	No obvious cause	Gradual	Swelling	Distended veins	No special treatment	1 mo.	Improved
314	Telford	1948	F	41	R	Driving drawing pins into hard board with her thumb	Gradual	Pain	Swelling: paresthesia	No special treatment	5 mos.	Improved
315	Telford	1948	M	39	L	No obvious cause	Gradual	Swelling	Distended veins	No special treatment	1 mo.	Improved
316	Telford	1948	M	48	R	Strenuous unaccustomed tennis few days before	Gradual	Swelling	Heaviness: pain: distended veins	No special treatment	10 wks.	Improved
317	Telford	1948	F	43	L	No obvious cause	Sudden	Pain	Swelling: discoloration	No special treatment	2 mos.	Improved
318	Telford	1948	F	26	R	No obvious cause	—	—	Swelling	No special treatment	11 yrs.	Partial disability
319	Telford	1948	M	58	R	Heavy work with hammer five years before	Sudden	Swelling	—	No special treatment	—	—
320	Warwick	1948	F	45	R	No obvious cause	Awoke	Swelling	Discoloration: pain	No special treatment	9 mos.	Partial disability

Certain of the published cases are doubtful and have been omitted here (Carere, 1911, Remijnse, 1932, Loehr, 1933, Kux, 1935, Tomasi, 1936). In other instances either insufficient details have been given, or the reference has not been available (Damaschino, 1887; Bogdanoff, 1912; Muselier, 1912; Hollander, 1921; Charbonell, 1930; Laubie, 1932; Ahlberg, 1936; Maza, 1939; Biebl, 1940).

special treatment. Whether the vein be resected or not, there is evidence that the obstruction is permanent; so that after taking all the facts into consideration it can be said that the operation is neither useful nor harmful but probably an unnecessary interference.

Delbet and Schwartz both removed the affected segment because of a faulty diagnosis, and their patients recovered quickly. Good results have been reported by others (30, 73, 74, 88, 111, 112, 118, 154, 178). Lenormant and Mondor (118) operated on their patient 6 days after the onset, while Guyott and Jeanneney intervened after 2 months. Cottalorda described an excellent result in a patient in whom a "spastic" vein was resected, although there were no signs of a thrombus, while Patel and Morel-Fatio, finding the axillary vein extensively involved by thrombus formation, removed only a part, yet the condition rapidly subsided after operation. However, Buxton stated that his own experience was less encouraging, and critical analysis of the cases reviewed here certainly reveals little to recommend the procedure.

Perivenous and periarterial sympathectomy. Theoretically, a perivenous sympathectomy interrupts the impulses from the "focus of irritation"; a periarterial sympathectomy is an operation designed to remove a particular efferent sympathetic pathway, i.e., that supplying the arterial trunks. Perivenous sympathectomy was performed with indifferent results in 2 of the cases presented by Roelsen in which no thrombus was found (177). Zehnder's patient was still showing improvement in his condition a month after operation.

Periarterial sympathectomy has been done only in 2 instances and in both as an additional step to excision of a venous segment; there was an aggravation of symptoms immediately after the operation but improvement followed (39, 89).

Other procedures. Wilson and Gautier reported "encouraging" results after multiple incisions in the arm, and others have observed considerable postoperative exudation of fluid through incisions.

SUMMARY AND CONCLUSIONS

1. This review concerns 320 cases of venous obstruction in the upper extremity; 285 of these have been previously reported in the literature.

2. The condition has aroused more interest among Continental authors than others.

3. The more or less rapid onset of venous obstruction in an arm of an otherwise healthy person constitutes a syndrome, and, in the absence of any unanimity of opinion regarding the etiology and pathology, it is suggested that the term "Paget-Schroetter syndrome" be adopted.

4. The age incidence rises abruptly to a maximum between 20 and 24 years; it falls off gradually, and relatively few patients over 50 years of age are seen. The youngest patient reported was a girl of 11 years, and the oldest, a man of 75.

5. Males are more frequently affected (78%).

6. The right side has been involved in 66 per cent of the cases.

7. Swelling of the arm is most often the first symptom, but pain, discomfort, or discoloration may occur at the onset.

8. The onset may apparently be quite sudden, but the condition usually requires from 24 to 48 hours to develop. In some cases there are premonitory symptoms for several days.

9. The whole of the arm and shoulder become involved in a firm "nonpitting" swelling which is due largely to venous engorgement but partly to excess interstitial fluid.

10. Discomfort and pain can be attributed to swelling, thrombus formation, and the retention of "pain-producing" metabolites.

11. A bluish discoloration of the arm is almost a constant feature.

12. The superficial veins, particularly those about the anterior aspect of the shoulder and chest, are always visibly distended.

13. Paresthesia and even pruritus may be experienced.

14. There may be tenderness along the course of the subclavian, axillary, and brachial veins, and in many cases a thrombosed vein has been palpable.

15. The presence of venous obstruction can be confirmed, if thought necessary, by estimations of the venous pressure, circulation time, oxygen saturation of the venous blood, as well as by intravenous and infra-red venography and other investigations.

16. Constitutional disturbances are negligible.

17. The diagnosis presents little difficulty. Cardiac failure, mediastinal compression, and metastatic carcinoma in the axilla can be excluded by clinical examination.

18. No case of this syndrome has ended fatally. It is doubtful whether nonfatal pulmonary embolism has ever occurred. The opposite arm is rarely involved. Symptoms may persist or recur and sometimes do so to a disabling degree. Although complete functional recovery frequently results, examination nearly always discloses some residual evidence of venous obstruction.

19. In many cases a thrombus has not been found at operation, and therefore thrombosis cannot be accepted as of primary etiological importance.

20. Abnormality of the circulating blood, infection of the venous wall, and general circulatory stasis are of no significance in the causation of this condition.

21. Injury to the vein resulting in thrombus formation on a roughened intima is the most popular conception. Each part of the axillary and subclavian veins has, at some time, been incriminated.

22. An extravascular obstruction is believed by the author to be the probable cause, with thrombosis a common sequel. A prevenous phrenic nerve may be the extravascular structure responsible.

23. Venospasm may play a role in the production of the clinical features, but it is difficult to attribute to it any etiological significance.

24. Anticoagulants should be administered as soon as possible after the onset. A paravertebral sympathetic block, which assists the developing collateral circulation, is advisable. If thrombus formation has already occurred, operative success cannot be anticipated; if this complication has not resulted, the collateral circulation should be adequate to compensate for the obstruction. Hence, surgical interference is probably not justified.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Surgical Anatomy of the Parotid Gland. HAMILTON BAILEY. *Brit. M J.*, 1948, 2: 245.

This is an excellent presentation on the surgical anatomy of the parotid gland with a review of the results obtained in 77 cases in which parotidectomy was performed. In 54 cases superficial lobectomy or total parotidectomy was performed and in the remainder extracapsular resection of a tumor was carried out.

There are considerable variations in the disposition of the facial nerve within the parotid gland, and for practical purposes it was stated that more often than not the facial nerve lies between a comparatively large superficial lobe and a variably sized deep lobe, the two being connected by an isthmus (see fig. 1). It is on this anatomical concept that operations of superficial lobectomy and complete parotidectomy

Fig. 1. Diagrammatic conception of a coronal section through the parotid gland, showing the branches of the facial nerve sandwiched between the superficial and deep lobes.

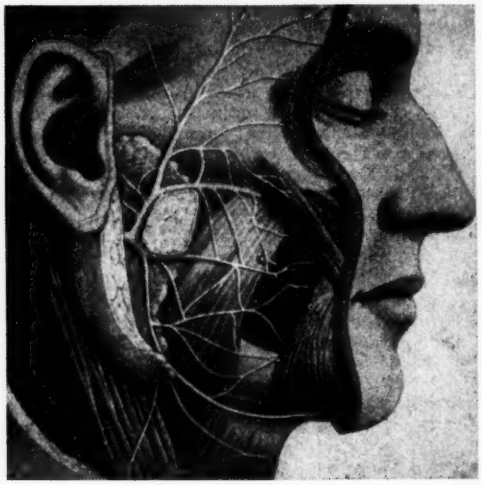

Fig. 2.

are rendered practical. Consequently a description of the surgical anatomy of the parotid gland is presented.

The facial nerve emerges from the base of the skull at the stylomastoid foramen. After a course of approximately 0.5 inch (1.25 cm.) it appears to plunge into the deep aspect of the gland a little below its middle. Actually it comes to lie in a groove on the under surface of the superficial lobe. For example, the main trunk of the nerve can be separated by blunt dissection from the mobilized gland. The main nerve trunk approaches the parotid isthmus from behind, and on reaching the isthmus divides into an upper temporofacial branch which passes above the isthmus and a lower cervicofacial branch which passes below it (Fig. 2). Because of the relatively small size of the deep lobe, outlying subdivisions of the nerve—for instance the pes anserinus—rest between the superficial lobe and the masseter muscle. Particularly from a surgical point of view, the temporofacial division, which is often the larger of the two divisions, is the most important.

In a number of instances, after the two primary divisions of the nerve have embraced the isthmus they are connected at a varying distance in front of the isthmus by one or more anastomotic twigs (Fig. 2). No doubt this accounts for some cases of unexpected late recovery of partial facial paralysis following parotidectomy.

The isthmus is variable. Sometimes it is relatively broad; even so, the primary divisions of the facial nerve seem always to embrace it.

The superficial lobe also varies in size and shape. Large superficial lobes often extend as much as 2 inches (5 cm.) into the neck (Fig. 3). On scores of occasions in the course of excision of adherent tuberculous cervical nodes situated in the upper third of the neck it was necessary to resect a portion of the cervical prolongation of the parotid gland.

The deep lobe may belong to one of two categories, the "knob" and the "rabbit warren." In approximately 40 per cent of the cases with the knob type the deep lobe is relatively small, ovoid in shape, and overlies the base of the condylar process (Fig. 4). It has been argued that if the tumor is removed satisfactorily by superficial lobectomy it is inconsistent with radical surgery to leave behind a piece of parotid gland (the deep lobe), even if this knob is presumed to contain normal tissue. However, it is oftentimes uncertain whether the deep lobe is strictly of the "knob" variety. In the rabbit warren type of case there is a prolongation with the deep surface of the deep lobe that plunges behind the posterior border of the mandible (Fig. 5) toward the styloid

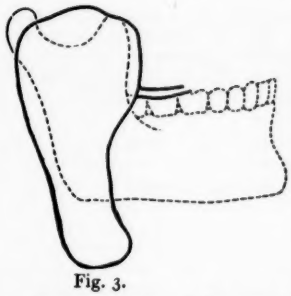

Fig. 3.

Fig. 3. Superficial lobe of the parotid gland with a cervical extension.

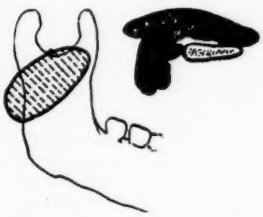

Fig. 4.

Fig. 4. Deep lobe: variety A, the "knob."

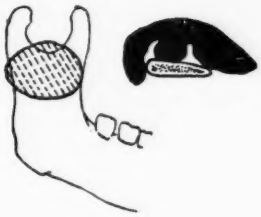

Fig. 5.

Fig. 5. Deep lobe: variety B, the "rabbit warren."

process which it surrounds. The most formidable possibility is that in the depths of the warren the deep lobe is adherent to the jugular vein near its bulb. For this reason more than for any other the operator can consider that the exacting operation is virtually completed when he is convinced that the deep lobe consists entirely of normal parotid tissue. After the deep lobes, including undoubted rabbit warrens *in situ*, are left, a salivary fistula following superficial lobectomy is often conspicuous by its absence.

The experience of the author in dissecting Stenson's duct in the living is at variance with what is depicted in works on anatomy. In over 80 per cent of the cases Stenson's duct is a rounded structure no larger than a fine hypodermic needle.

In a review of the results of parotidectomy by the author, 45 of 54 patients were treated for tumors. In 17 cases the tumor was a recurrent one. In 1 case it had recurred 4 times, and a number of patients had received radiotherapy without benefit.

As for the integrity of the seventh nerve, in 2 patients no attempt was made to preserve it, because in one the nerve had been cut at a previous operation performed elsewhere, and in the other the neoplasm was so extensive and friable that the anatomy of the region was confused. Of the remaining patients, over 40 per cent had temporary facial palsy lasting for varying periods up to a year. Only 5 of these showed signs of facial muscular weakness after a year, but none of them were seriously inconvenienced.

In all instances the patient is warned before parotidectomy that the integrity of the seventh nerve cannot be guaranteed and a degree of facial palsy must be expected for several months.

Regarding the pure anatomy of the facial nerves, as far as the author was able to ascertain, Barry Anson, professor of anatomy, Northwestern University of Chicago, stands alone among English-speaking anatomists in teaching that the parotid gland is a bilobed structure with the facial nerve running between the lobes. The author supports this contention through his experience in the surgical treatment of the parotid gland.

JOHN E. KARABIN, M.D.

EYE

Research in Orthoptics. F. ELIZABETH JACKSON *Am. J. Ophth.*, 1948, 31: 805.

The author points out that certain essentials are necessary to obtain a truer perspective of the whole field of binocular training and of the treatment of strabismus. In order to benefit from research in orthoptics, the terminology used in orthoptics should be clarified on the basis of ophthalmic technology, the evaluation of results should be standardized, variable factors should be eliminated, and sensory data should be collected and analyzed to stimulate and direct further study of the etiology, manifestations, and over-all treatment of strabismus. In addition, some knowledge of the basic principles of child psychology would be helpful so that a better understanding could be acquired of what can be expected of a child at various age levels.

Time and effort involved in research in orthoptics can be minimized by keeping records of the diagnosis, treatment, and the follow-up data on all cases, and by keeping an abstract file of current publications.

The results of research in orthoptics can be given as a statistical survey, a comparison study, and individual case reports. JOSHUA ZUCKERMAN, M.D.

Pathogenesis of Myopia: A New Classification. FREDERICK C. STANSBURY. *Arch. Ophth.*, Chic., 1948, 39: 273.

The various theories of myopia are critically and historically reviewed in a comprehensive and scholarly manner. After careful consideration of the various theories, the author proposes a classification of myopia into (1) primary, or physiological, myopia and (2) secondary, or pathologic, myopia.

The concept of primary myopia is based upon the view that refractive errors are biologic variations and that people are hypermetropic or myopic by the same chance variations as people are short or tall. It includes myopia of both high and low degreees with the vision correctable to normal standards and the eye healthy.

Secondary myopia is a disease of the eye, the cause of which has not been determined, but which

may be a chronic low grade choroiditis. It is associated with fundus lesions such as staphyloma, myopic crescent, choroidal atrophy, degeneration and hemorrhage, retinal atrophy, and pathologic changes in the vitreous. The main factor in diferential diagnosis of the two types is the appearance of the fundus. Proper classification is of great value clinically, in therapy, in prognosis, and will prevent the waste of many useful citizens as "myopic cripples." FRANK W. NEWELL, M.D.

Ligament of Lockwood in Relation to Surgery of the Inferior Oblique and Inferior Rectus Muscles. WALTER H. FINK. *Arch. Ophth.*, Chic., 1948, 39: 371.

The author presents an anatomical study of the suspensory ligament of the eye and its importance in the management of abnormalities of the inferior oblique and inferior rectus muscles.

Excellent reasons why surgery of the inferior oblique muscle should be done at its insertion rather than its origin, are indicated. Fusion of the sheaths of the two muscles is very variable and surgery at origin is therefore also unreliable and variable.

In operating upon the insertion of the inferior oblique muscle, the insertion of the muscle sheath is also of great importance, and severance of the sheath is essential for good results. The recession and reattachment of the muscle should be in line of action of the muscle. The illustrations are clear and self-explanatory. EARL H. MERZ, M.D.

Effect of Roentgen Therapy on Experimental Ocular Vaccinia in Nonimmune and in Partially Immune Rabbits. GEORGE T. HARRELL, CHARLES H. REID, J. MAXWELL LITTLE, JAMES W. MANKIN, AND OTHERS. *Arch. Ophth.*, Chic., 1948, 39: 313.

The effect of direct irradiation at different stages of ocular vaccinia in nonimmune and partially immune rabbits was investigated. Rabbit eyes were irradiated in 24 to 48 hours after inoculation with calf lymph virus, at varying intervals after vesiculation commenced, and at the height of the reaction.

Irradiation was of value as a means of hastening regression of the acute lesion and decreasing residual corneal opacities. This latter observation was not borne out by measurement of the transmission of light with a photoelectric technique. Additional animals were partially immunized by primary inoculation of the skin, and 72 hours later the corneas were inoculated. At varying intervals thereafter the corneas were treated with roentgen therapy. Results were similar to those observed in nonimmune animals although, in general, the disease was less severe and the residual opacities less. Partial immunity without irradiation also protected against residual corneal opacities.

The authors discuss the possible causes of the discrepancy between simple clinical observation of the corneas and the statistical comparison of objective measurements of light transmission with a photoelectric colorimeter. FRANK W. NEWELL, M.D.

Experimental Studies of Ocular Tuberculosis: Failure of Penicillin to Affect the Course of Experimental Ocular Tuberculosis. JOHN D. KENNEDY, ALLAN C. WOODS, JOHN BUCKLEY, MORGAN BERTHRONG, AND EARL L. BURKY. *Arch. Ophth.*, Chic., 1948, 39: 261.

The anterior chambers of rabbits were inoculated with a culture of virulent human type of tubercle bacilli. Five weeks later animals with similar lesions were divided into treated and control groups. The treated rabbits received 50,000 units of penicillin G subcutaneously four times daily for 45 days. The course of the ocular tuberculosis was similar in the two groups and there was no clinical evidence of any inhibitory effect of the penicillin in the treated animals. The number of animals with visceral involvement was similar in both groups. Evaluation of the microscopic appearance of the eyes and viscera indicated less total ocular tuberculosis, less total ocular caseation, and less total ocular and visceral tuberculosis in the treated group; however, the analysis indicated that these findings were not statistically significant.

It was concluded that the sample of penicillin G used had no therapeutic effect on ocular tuberculosis in nonimmune rabbits. FRANK W. NEWELL, M.D.

Normal Optic Nerve: Classification of the Optic Disc Based on Branching of the Central Retinal Artery. EVERET H. WOOD. *Arch. Ophth.*, Chic., 1948, 39: 305.

The author presents a classification of optic nerve types based upon division of the optic nerve into quadrants, and observation of the distribution of the four main branches of the central retinal artery in the various quadrants.

In a study of 500 individuals, the most common type presented a distribution of both inferior branches in the nasal inferior quadrant with distribution of the two superior branches in the two superior quadrants (35.2%); the second most common type had a symmetrical distribution with branches in each quadrant (32%); the third most common type had the distribution of all vessels on the nasal side of the disc (16.6%). There were none of the type with all branches on the temporal one-half of the disc. Most of the individuals observed (58.4%) had dissimilar optic discs. FRANK W. NEWELL, M.D.

Observations on the Pulse and Retinal Arterial Pressure. W. KAPUŚCIŃSKI. *Brit. J. Ophth.*, 1948, 32: 273.

This article concerns the arterial movements in the central retina of the eye, which are magnified fourteen times and easily studied.

In the fundus oculi we observe, simultaneously with the pulse, arterial movements depending on the impetus given by the local artery. These movements appear in two phases. The first phase, due to cardiac systole, is rapid; the second, due to diastole, is slow. Any other movements, viz., arterial dilatation and contraction, do not take place. The

same pressure movements may be observed in all arteries of visible organisms, and there are no other movements performed by the arteries. The pressure movements in question are directly due to cardiac systole and diastole, and arise as the result of periodical changes in arterial pressure. Notwithstanding that the arteries do not perform peristaltic movements, they are, because of their structure, able to give an impetus to the onflow of the blood stream in the circulation on the basis of simple mechanical laws. The arterial pressure movements are actually the pulse. The pulse, therefore, does not depend on arterial dilatation and contraction. The facts mentioned about arterial pressure movements, together with the complete immobility of the arterial tubes, lead to the conviction of the unreality of the present theory on the cause of the pulse. A "false" pulse is met with in the artificial product caused by pressure. The blood stream in its first phase originates at the genesis of life, and continues to flow on uninterruptedly, receiving a rhythmic stimulus due to cardiac systole.

Summing up all of his results in brief, the author states that the arterial "pulse" as well as the venous "pulse" is a passive pulse produced by a rhythmic throb due to eyeball pressure. The blood stream in the vein is uniform, circulating without any oscillations because of pressure, so that there is no difference between diastolic and systolic pressure. Because of a fundamental error of Bailliart's method, pressure pulse has been identified with spontaneous pulse. A spontaneous pulse in the retinal artery comes nearer the truth. It can be observed in 80 per cent of quite healthy individuals who are not suffering from circulatory disturbances. The result turns out to be different in cases of rapid pulse. This depends on the rhythmic onward thrust of a section of the artery, due to cardiac systole, in the same way as the pulse in other arteries. However, only adequate experience in the observation of spontaneous pulse could afford an answer to the question of pressure in the retinal vascular system. Unfortunately, such experience is humanly impossible.

The methods of investigating pressure in the brachial artery cannot be adopted for the measurement of pressure in the retinal blood vessels. The pressure on the eyeball creates entirely different circulatory conditions, so that there is no analogy between these two methods. Considering that the physiological arterial pulse is hardly perceptible, the difference between systolic and diastolic pressure is practically nil, and is therefore not capable of being measured. If conditions were such as suggested by Bailliart and others, i.e., 0.45:1, the spontaneous pulse in the retinal artery would necessarily be seen in every eye at once and would necessarily be more distinct than the arterial pulse, in which this proportion amounts to 0.6:1.

By Bailliart's method we are able to investigate the height of retinal venous pressure, in so far as the vein does not present independent "pulsation," i.e., pulsation occurring already without pressure. Bailliart's method does not enable us to estimate pressure in the central retinal artery, but we can thereby determine the approximate pressure existing in the ophthalmic artery.

In consideration that the central retinal artery is considerably narrower than the ophthalmic artery, the pressure in it must necessarily be considerably lower, which, however, cannot be determined even approximately. EARL H. MERZ, M.D.

EAR

Minimal Shock Pulse Trauma to the Cochlea—Acute and Chronic. H. B. PERLMAN. *Laryngoscope*, 1948, 58: 466.

The author presents his views following a study of the literature on blast trauma to the middle and inner ear. Many reports are cited which indicate that damage to the inner ear as the result of industrial noises, gun shots, and other battle noises, often with little or no evidence of injury to the middle ear, may occur. His purpose was to perform experiments in which the cochlea was damaged by an explosive sound but no damage was done to the middle ear.

The experimental animal used was the rabbit. The bulla was exposed and perforated to provide a view of the middle ear structures, and an ear speculum was inserted through the perforation, through which, by reflected light, the tensor tympani muscle was observed. The threshold for acoustic contraction of the tensor tympani was observed by presenting pure tones generated by a Western Electric 6 B audiometer through a loud speaker next to the operated ear. The intensity at each frequency needed to produce a just visible contraction of the tensor tympani when the tone was suddenly turned on and off was recorded. Average readings were taken as the threshold response for the ear. The opposite ear in all acute experiments was destroyed by entering the bulla and knocking off the promontory. In some chronic experiments, both ears were used.

After establishing a threshold, a starting pistol was fired, near the speculum in most cases, and the threshold of the tensor tympani contraction to pure tones was again determined at intervals of a few minutes to several hours. The shock pulse was developed by a 32 caliber blank cartridge fired from the starting pistol at a distance of 1 to 2 feet from the animal. A group of animals also, after exposure to the pistol shot, were allowed to live from periods of 3 to 12 weeks. After the experiments the temporal bones were immediately excised, placed in fixing solution, and ultimately sectioned serially.

In an analysis of the material obtained in these experiments, the author found the following:

1. Small changes in auditory functions in these animals as tested by the tensor tympani response may be accompanied by little histologic evidence in the cochlea of damage.

2. Profound loss of auditory function so tested seemed out of proportion with the limited histologic damage of the cochlea.

3. It was evident to the author that definite end-organ damage and profound functional loss could be produced by shock pulses that did no visible damage to the middle ear structures.

4. In the animals showing a partial functional loss of the tensor tympani response, no uniform predilection for the high frequencies was noted.

5. Two functional reactions were observed: (a) evidence of recovery within several hours after exposure, (b) "a rather rapid progressive obliteration of function" within a few minutes after the immediate postblast threshold was taken.

6. No clear-cut relation was seen between the partial loss of function and the position of damage in the cochlea. JOHN J. BALLENGER, M.D.

PHARYNX

Neuron Arcs of Clinical Significance in Laryngology. A. C. FURSTENBERG AND ELIZABETH CROSBY. *Ann. Otol. Rhinol.*, 1948, 57: 298.

Specifically, the text treats of certain respiratory reflexes and the neuron pathways along which they travel. An attempt is made to describe various nerve circuits composed of peripheral, nuclear, and associated routes, and to explain by reason of their position, relationships, and function, some of the phenomena observed in clinical practice.

While much of this subject may be of only academic interest, it is nevertheless axiomatic that the basic sciences form the foundation of medicine. From a knowledge of them, one may travel in any direction. A veritable panorama of opportunity is exposed to the individual whose interest is grounded in the fundamental principles of some phase of science: the opportunity for intelligent observation, research, the development of therapeutic facts, and the ability to put these facts into discriminate practical usage. It may not be too much to expect, therefore, that this anatomical study of some of the reflexes of respiration may serve as a common core about which a better understanding of respiratory symptoms and a greater knowledge of rational methods of treatment may be developed.

Among the respiratory reflexes of clinical importance are hiccough, coughing, and sneezing. The author believes that the symptom of coughing is more often than not an expression of some strong feeling or impulse of a psychogenic nature.

The absence of pathologic changes about the brain stem in individuals who had died of meningitis gave rise to doubt that direct stimulation of the vagus nerves and later paralysis of them were responsible for the respective slowing and acceleration of respiration. The inquiry into a more rational explanation for these changes arose particularly from autopsy findings in cases of meningitis secondary to nasal accessory sinus disease in which the exudate was largely confined to the surfaces of the brain.

While the text probes only superficially into the emotional factors responsible for respiratory variations such as hiccough, sneezing, and coughing, it deals specifically with the central nervous apparatus along which emotional impulses are carried. A knowledge of these pathways and a better understanding of parent-child relationships may widen our knowledge of the psychology of cough and asthma.

In discussion of the reflex arc of sneezing, an effort is made to offer an explanation on an organic basis for the occasional complaint of nasal obstruction after a submucous resection of the septum in a patient who has wide open nasal cavities.

Finally, this initial inquiry into the nervous mechanism of respiration and its common variations leads one to the conviction that much more work needs to be done if we are to achieve a thorough survey of this subject. The one generalization that may be derived from this discussion is that the whole mechanism of respiration is a complicated one governed by a reflex arc and an equally important central nervous system component susceptible to emotional stimulation.

There are 4 drawings of the various nerve circuits described in the text. JOHN F. DELPH, M.D.

Tonsillectomy-Poliomyelitis Survey—1947. DANIEL S. CUNNING. *Laryngoscope*, 1948, 58: 503.

In an attempt to elucidate the relationship between recent tonsillectomy and the contraction of poliomyelitis, the author reports the statistical results of questionnaires which traced 43 per cent of the cases of poliomyelitis reported throughout the country in 1947. The report is contrasted with a similar one previously published, which gave analyses of 23 per cent of the cases reported in 1946.

The 1946 survey showed that in 2.5 per cent of all cases of poliomyelitis followed, the disease was preceded by a tonsillectomy, while in 1947 the figure was 0.5 per cent. In 1946, 1.1 per cent of the cases of poliomyelitis were preceded by various operations other than tonsillectomy, whereas in 1947, 1.9 per cent of cases were preceded by other operations—about 4 times as many as were preceded by tonsillectomy.

In addition to the surveying of the cases of poliomyelitis, 5,439 tonsillectomies performed in 15 different states in 1947 were followed for a period of 2 months post-operatively. Among this total, 2 cases of poliomyelitis were discovered.

In conclusion the author states that he is more convinced than ever that there is no causal relationship between recent tonsillectomy and the development of poliomyelitis, and that when a bulbar poliomyelitis follows a tonsillectomy it is purely coincidental. JOHN J. BALLENGER, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Actinomycosis. J. Robert Jacobson and Ralph B. Cloward. *J. Am. M. Ass.*, 1948, 137: 769.

The authors present a report of the first verified case of actinomycosis of the central nervous system, with recovery. Prior to the advent of chemotherapy (1937) a review of the entire medical literature revealed some 108 cases of actinomycosis of the central nervous system. The disease was routinely fatal. After the advent of the sulfonamides and antibiotics several recoveries of systemic actinomycosis were reported. Recent literature has stressed the specific value of these drugs in actinomycotic infections.

A detailed case report is presented and the importance of the bacteriological examination is stressed. The average case shows thick pus in the spinal fluid with high cell counts, predominantly polymorphonuclear leucocytes; sugar is absent. The temperatures range from 101 to 102 F. The patients do not appear as toxic as would be expected from the abnormalities noted in the spinal fluid. There is usually paralysis of several cranial nerves. The white blood cell count ranges from 17,000 to 25,000. Sudden, unexpected death in a patient who seems not too acutely ill is characteristic of the disease.

This particular patient received intensive treatment with sulfadiazine, penicillin, and streptomycin.

Howard H. Lander, M.D.

Treatment of Thoracogenic Brain Abscess. J. B. Pennybacker and T. Holmes Sellors. *Lancet*, Lond., 1948, 2: 90.

A review of 20 consecutive cases of thoracogenic brain abscess revealed that 7 patients recovered from the cerebral infection and 6 were still alive. These 20 cases were observed among 100 patients with brain abscess who were treated in the Nuffield Department of Surgery, Oxford, during the past 9 years.

Thoracogenic abscess is usually multilocular, but the main mass is often single and discrete, and in only 4 of the 20 cases were there multiple abscesses scattered throughout the brain. Abscesses, like metastatic tumors, appear to develop at the junction of gray and white matter, and in only one case was there a deep seated lesion and this was in the optic thalamus.

Bacteriological findings included 10 different types of organisms, and 2 that were sterile.

These abscesses are not generally considered suitable for the type of treatment which aims at radical removal in the chronic, encapsulated stage but the use of penicillin and sulfonamides has been of great aid in their successful treatment.

A detailed report of 6 cases is given and the method of treatment is described. Elimination of the chest sepsis or, at any rate, its control by minor surgical and palliative measures should always be attempted so that the risk of cerebral infection is minimized. Radical surgical measures directed at the thoracic infection and its elimination should be taken. If the patient is very ill, a burr hole is made over the abscess, and aspiration is undertaken to tide him over the critical period. Radical removal can occasionally be undertaken if the patient's condition permits. Arteriography has been employed as a localizing agent, although in other cases ventriculography is necessary.

It is advised that if the abscess is aspirated or sucked out in the acute stage, the resulting cavity should be treated with penicillin at the time, and the dura and bone flap dusted with penicillin sulfamezathine powder. The bacteriology of the abscess and its susceptibility to antibiotics should be determined at the earliest possible time. Closure without drainage is recommended. Treatment of the brain abscess should be undertaken before chest surgery, if possible.

The advent of any cerebral symptoms in a patient suffering from pulmonary infection calls for immediate neurological investigation for the possibility of a developing brain abscess.

Howard A. Brown, M.D.

Transorbital Lobotomy. Charles H. Jones and James G. Shanklin. *Northwest M.*, 1948, 47: 421.

A brief résumé is given with regard to prefrontal lobotomy and its further development in this country and abroad.

Transorbital lobotomy was introduced by Fiamberti in 1937. The technique as developed by Freeman in this country is described. It includes two electrically produced convulsions, and lobotomy is performed on one side during the coma following the second seizure. This is immediately followed by a third electric shock, and the other side is operated upon during the ensuing coma. The instrument consists of a pointed, circular shaft of steel 14 cm. long with an attached handle. It is calibrated 7 cm. from the tip.

The patient is placed upon his back during the state of coma, and the eyelids are elevated by the operator who then pierces the orbital conjunctiva near the posterior margin of the conjunctival sac. The instrument is held against the ball of the orbit and parallel to the bridge of the nose, and a small mallet is used to tap the shaft into the anterior cranial fossa until the seventh centimeter mark approximates the margin of the upper eyelid. After its position is carefully checked, a lateral photograph is taken with the instrument in place. At this point the instrument is firmly fixed in the superior orbital plate, and usually will not move if the operator's hand is taken away. However, the fixation is easily overcome as the lateral and medial movements are made.

Very little resistance is felt to the passage of the narrow shaft as it is moved through the brain. A movement of 15 degrees medially and laterally severs the connections in the subcortical white matter, and displaces the cortical arteries without lacerating them. A greater sweep of the instrument is unnecessary, and may be dangerous. On being brought back to the midline of the orbit, the instrument is carefully withdrawn. With the withdrawal of the instrument, a gauze pad soaked in a saturated solution of boric acid is applied over the eye with firm pressure, to minimize hemorrhage into the orbital tissues.

No preparation of the operative site is necessary as the instrument is introduced into a sterile field—the conjunctival sac.

Forty-one patients, whose cases are reported in this series, were subjected to this type of operative procedure. There were 26 cases of schizophrenia, 6 cases of manic depressive psychosis, 3 cases of agitated depression, 2 of severe mixed-type psychoneurosis, 2 of obsessive compulsive neurosis, 1 case of involutional melancholia, and 1 case of intractable pain of the thalamic syndrome. Twenty-six of the patients were women and 15 were men. The oldest patient was 67 years of age, and the youngest was 18 years.

The results were classified as "good," "fair," and "poor." A good result is one in which the patient has the capacity to adjust outside the hospital with little, or no, supervision. A fair result implies either that the patient can get along on a parole status with moderate supervision, or that there has been a striking improvement in his behavior to a point where very little hospital supervision is required. Although the patient may show improvement in many ways, the result is regarded as poor if considerable hospital supervision is necessary.

Thirty-five patients whose postoperative period was longer than 1 month were graded on the above basis: 16 received a good result, 12 a fair result, and 7 a poor result.

The immediate postoperative course is said to differ sharply from that of prefrontal lobotomy, and the patient is ambulatory as soon as the effect of electroshock anesthesia subsides. He may present one or two black eyes as the only physical evidence of having undergone surgery. No deaths were reported.

A unilateral ptosis of the upper eyelid was produced in 4 cases, but gradually disappeared.

HOWARD A. BROWN, M.D.

PERIPHERAL NERVES

Lacerative Lesions of the Brachial Plexus (Le lesioni da strappo del plesso brachiale). LEONARDO GUI. *Chir. org. movim.*, 1948, 32: 97.

Eight cases of paralysis of the brachial plexus from the Putti Institute of Bologna, Italy, form the basis of this report. All of the patients were soldiers. In 5 cases the injuries were due to motorcycle traffic accidents; in 1 case the injury occurred as the result of a falling beam during bombardment, in 1 as the result of a fall from a horse, and in 1 as the result of a railroad accident.

In all of the injured, the plexus was exposed upward to the point of issuance of the nerve roots from the intervertebral foramina and downward into the axilla, if indicated, through an incision from the upper end of the sternocleidomastoid muscle, across the clavicle and then downward and outward onto the chest. The clavicle was cut through and, if necessary for exposure or nerve suture, a section of this bone was resected together with the subclavicular muscle.

In 2 cases the symptomatology indicated the interruption of the fifth and sixth cervical roots; in 5 cases the syndrome was that of total interruption of the plexus, and in the remaining case the condition was diagnosed as a dissociative paralysis of the lateral and posterior fasciculi.

Of the 2 cases of upper root disturbance, no interruption of the nerves was found at operation in one; here a simple nerve lysis was done and the motor function of the muscles returned to normal; some sensory disturbance remained. In the other patient there was uncovered interruption of the fifth root and avulsion of the sixth spinal nerve root from the medulla. Here the peripheral stumps of these nerves were united by nerve suture to the fifth root and the patient recovered active contractions in the bicipital, pectoral, and long supinator muscles.

In the instance of dissociated paralysis also, the peripheral trunks (axillary and radial nerves) could be reunited to their corresponding posterior fasciculus and the interrupted part of the lateral fasciculus could be reunited *in situ*. This patient regained active contraction of the deltoid and triceps muscles. In one case in which suture was possible, all three fasciculi were reunited to their proximal stumps; here, however, the operation has been too recent for evaluation.

In the remaining 4 cases, a careful and extensive nerve lysis was all that could be attempted; however, in 3 of these the pains were largely or completely relieved. In the fourth patient, it is believed that the source of the pain was an irritative condition in the spinal cord itself, resulting from the injury suffered in avulsion of the nerve roots, and that only a chordotomy would bring alleviation.

The author reports no experience in implanting the peripheral stump of the interrupted nerve into an intact root and he does not subscribe to the suggested periarterial sympathectomy for the relief of pain in these cases, since he thinks that neurolysis will accomplish all that can be done. Early operation is favored, and excellent results are reported for the combining of intramuscular injections of evipan (8 to 10 c.c.) with general ether anesthesia, and for the use of an aspirator and the electrocoagulator during the operation in these highly vascular tissues.

JOHN W. BRENNAN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Carcinoma of the Premenopausal Breast. CHARLES M. WAGGONER. *Ann. Surg.*, 1948, 127: 1256.

The effect of ovarian function on the production of carcinoma of the breast has long been studied experimentally and in human beings. The palliation in breast malignancy after oophorectomy has also been shown. Widespread administration of estrogens, however, has been followed by relatively few breast cancers, and these have been thought to be coincidental. The author reports the case of a 44 year old woman with extensive carcinoma of both breasts and widespread metastases who six months previously (at which time the breasts were said to have been normal) was started on a course of theelin therapy for menstrual irregularities which at first had caused painful swelling of both breasts. The patient was considered to be in the terminal stage when seen, but she began to improve and lived 19 months before succumbing to overwhelming metastases. At autopsy, widespread disease was found, including complete replacement of ovarian tissue by tumor. It is suggested that the patient's clinical improvement was due to the loss of ovarian substance occurring with peritoneal spread of the tumor.

Thirty-nine additional cases of women under 50 years of age with breast malignancy are reviewed with regard to abnormal endocrine patterns as reflected in menstrual abnormalities. Thirty of these presented clinical evidence of hormonal imbalance. Specific factors remain unknown, but the relationship of ovarian hormones to breast malignancy is suggested by these cases.

JESSE E. THOMPSON, M.D.

TRACHEA, LUNGS, AND PLEURA

The Volume of the Bronchial Tree at Various Levels and Its Possible Physiologic Significance. A. C. HILDING and DAVID HILDING. *Ann. Otol. Rhinol.*, 1948, 57: 324.

There is a small progressive increase in the volume of the tracheobronchial tree from the larynx to the bronchi, measuring 1.5 mm. in diameter. It is from 50 to 100 per cent. In this portion of the tree there does not seem to be any very effective air cleansing device, except the direct impingement of the air on the mucous blanket lining the tree. There appears to be a very considerable expansion in the volume of the tract in tubes of less than 1.5 mm. in diameter. Before the cilia cease, the tree has divided into bronchioles which number somewhere between 15,000 and 70,000, each of which is lined with ciliated epithelium and a sticky mucous blanket. The total circumference of these tubes measures many meters. This "bronchiolar filter" is an effective, final device to protect the alveoli from dust and fumes which may gain access to the trachea. It is probable that the cilia move off the mucous blanket, as is the case elsewhere in the tract. If sufficient secretion is produced, this bronchiolar filter could be even more effective than the nose in dust removal and humidification. It does not, of course, protect the trachea and the larger bronchi from improperly prepared air.

SAMUEL KAHN, M.D.

A Contribution to the Study of the Pulmonary Hilum. The Hilum of the Right Upper Lobe (Contribucion al estudio de los pedículos pulmonares. Pediculo lobar superior derecho). A. RUIZ LIARD. *An. Fac. med.*, Montev., 1947, 32: 1029.

The present article coming from the Instituto de Anatomia Normal of the Faculdad de Medicina de Montevideo represents a rather exhaustive treatise on the descriptive anatomy of the bronchial and vascular supply to the right upper lobe of the lung. A brief description of the grouping of hilar lymph nodes is likewise given.

In summary form and without any attempt to correlate the nomenclature used, the principal points may be given as follows:

The bronchus to the upper lobe is distinguished by its short length (10 to 12 mm.) and its virtually horizontal course. It divides into three branches: (1) apical, which further gives off an anterior, posterior, and apicoaxillary branch; (2) ventral, which gives off a superior and inferior ventrosternal branch, as well as a ventroaxillary branch; and (3) dorsal, which gives off a dorsoaxillary and a dorsovertebral branch.

The arterial supply can be classified into three sources of origin: (1) the constant supply reaches the lobe through the first branch arising from the pulmonary artery, and supplying 50 to 100 per cent of the blood to this lobe (the pattern of branching exhibited by this artery is highly variable); (2) in 92 per cent of cases there are branches to the lobe which arise directly from the main trunk of the pulmonary artery, below the level of the principal lobar artery referred to above; they occur as ventral or dorsal branches and supply the ventrosternal, ventroaxillary, dorsoaxillary, and dorsovertebral segments as referred to; and (3) quite rarely (in 2 to 4% of cases) there may be vessels supplying the upper lobe arising from the artery to the middle lobe or to the dorsal segment of the lower lobe.

The venous trunks from the upper lobe unite to form the vein of the upper lobe which, in turn, joins the venous trunk from the middle lobe to form the superior pulmonary vein.

From the upper lobe the principal branches are of two classes: (1) the deep tributaries which are referred to as apicoventral, apicodorsal, and ventroaxillary; and (2) the superficial tributaries which are called either mediastinal or fissural.

The lymph nodes at the hilum are divided into groups: (1) the superior group, located just below the azygos arch, (2) the middle group, located between the main pulmonary artery and its chief branch to the upper lobe, and (3) the inferior group, located in front of the hilar portion of the lobar vein. The chief group of lymph nodes is the middle group; the inferior group is present in only 20 per cent of cases.

The treatise is illustrated by 9 three-colored plates, and is accompanied by schematic drawings that are well labelled.

Practical points of application to the surgical removal of the right upper lobe are made. Twenty-seven bibliographical references are added.

HIRAM T. LANGSTON, M.D.

Hernia of the Lung (Hernia de pulmon). ALEJANDRO J. PAVLOVSKY and VICENTE LAVENIA. *Bol. Acad. argent. cir.*, 1948, 32: 292.

Herniation of the lung is a rather rare condition, even though references to it have been made by ancient writers.

Its occurrence implies a forceful increase in intrapulmonary pressure (such as may occur during coughing, defecation, vomiting, or sudden effort against a closed glottis), impinging on a defect in the chest wall. This locus minoris resistenciae may be the result of trauma and local muscular atrophy, or of congenital malformation. It occurs most often in the anterolateral portion of the chest wall. The character of the swelling and its increased size during forced expiration should suggest the diagnosis of hernia. The roentgenogram can usually be depended upon to demonstrate the exact nature of the lesion, when taken tangentially to the chest wall.

The authors believe that hernia of the lung should be treated surgically, and that other forms of palliative management, such as the use of trusses, are unsatisfactory. Their method of repair consists essentially in mobilization of the sac and its careful closure. This portion of the procedure implies an open pneumothorax, and endotracheal anesthesia is recommended. The chest wall defect is closed by suture, reinforced by suturing an osteoperiosteal flap obtained from the rib above the defect to a periosteal flap obtained from the rib below the defect, and imbricating them over the hernial ring. The superficial tissues are carefully closed over this in anatomical fashion with overall pressure dressings.

A case of lung hernia is reported in a 38 year old laborer whose acute symptoms were brought on by heavy lifting. The hernia occurred at the site of a stab wound incurred 17 months previously. This method of repair was satisfactorily employed.

HIRAM T. LANGSTON, M.D

Experiences in the Surgical Treatment of Pulmonary Stenosis. JOHN R. PAINE and RICHARD L. VARCO. *Surgery*, 1948, 24: 355.

The authors review their series of 43 patients between the ages of 1.5 and 24 years, on whom they performed the Blalock-Taussig operation for the relief of pulmonary stenosis.

The most common type of shunt made was an end-to-side anastomosis of the subclavian artery to the pulmonary artery (35 cases); in 5 cases an end-to-side anastomosis of the innominate artery to the pulmonary artery was done; and in 2 cases an end-to-end anastomosis of a subclavian artery to a branch of the pulmonary artery was done. In 5 cases only exploration of the mediastinum was done. In the recovered patients, almost uniformly good results presenting increased physical endurance were observed; there were also increased oxygen saturation of the blood at the average of 15 per cent and a correlated decrease in polycythemia and cyanosis.

Nearly all of the patients showed postoperative pleural effusion, which in 8 instances necessitated aspiration because of dyspnea. Also there was noted an increase in the size of the heart after operation which was thought to be indicative of mild cardiac decompensation.

In 3 patients diffuse brain damage, due presumably to inadequate oxygenation, was noted. Two of these patients never regained consciousness. Three patients also died of cardiac standstill in spite of the injection of 1 per cent novocain into the vagus nerve and around the hilus of the lung.

The authors emphasize that these patients are best handled by a "team" consisting of a pediatrician, a roentgenologist, an anesthetist, and two surgeons.

In view of the technical difficulties of an anastomosis on the right side, the authors believe that in cases in which the preoperative oxygen saturation is over 50 per cent and only a small shunt is needed, an approach on the left side uniting the subclavian with the pulmonary artery is preferred to the formation of an innominate-pulmonary artery shunt, which has an appreciably higher mortality.

The authors elaborate on the technique and the anesthesia used, and also the psychometric observations before and after operation.

JANE C. MACMILLAN, M.D.

Preoperative Bronchoscopy in Lobectomy for Tuberculosis (La bronchoscopia preoperatoria nella lobectomia per tubercolosi). M. ARSLAN and A. SCARPA. *Minerva med.*, Tor., 1948, 39: 345.

The authors suggest preoperative bronchoscopic study of the tracheobronchial tree in tuberculous patients in whom lobectomy is contemplated, and present a report of 3 cases in which such a study was very helpful.

In the first case the bronchoscopic study revealed a large rigid cavity which contraindicated surgery.

The second case was that of a patient 32 years old, in good physical condition, apyretic, and with a large cavity in the right superior lobe of the lung. Bronchoscopic examination revealed the bronchus to be fibrosclerotic and stenosed up to its bifurcation, which necessitated a reserved prognosis. The operation, though technically difficult, was successful; however, on the twentieth postoperative day the

patient developed an empyema with a fistula in the operative scar. The fever subsided after insufflations of streptomycin, and general improvement followed. Because of lack of the antibiotic, the empyema recurred and the patient died.

The third case was that of a patient 26 years old, in good physical condition, and apyretic. He had a large paramediastinal cavity of the inferior left lobe circumscribed by interlobar and parietal adhesions. Bronchoscopy revealed slight inflammation of the mucosa of the left superior bronchus with minimal mucosal secretions, which suggested a good prognosis. The operation was uneventful and the patient is at present in good physical condition and apyretic.

The authors conclude that (1) bronchoscopic examinations preceding lobectomy for tuberculosis enable the surgeon to decide the feasibility of surgical intervention; (2) operability depends upon the condition of the tracheobronchial routes; (3) specific infiltration of the respiratory pathways involving the lobar bronchus to be removed must be treated conservatively because of the possibility of spread of the infection.

The authors describe their method of bronchoscopy in the tuberculous patient, and advise its use before lobectomy is performed.

JOSEPH M. A. PAPE, M.D.

Pulmonary Abscesses Attended with Pleural Complications. JENS L. HANSEN. *Acta chir. scand.*, 1948, 96: 493.

The writer reports a material comprising 100 cases of pulmonary abscess of which 32 were associated with pleural complications, 27 with empyema, and 7 with pyopneumothorax. The incidence of pleural complications is the same in the presence and absence of stenosing bronchial affections. They are most common in connection with abscesses of the lower lobes. Definite rupture of the abscess was demonstrated in 21 cases. Putrid effusion was found in 23 cases, 17 of which exhibited nonhemolytic streptococci. In a large number of cases there will be complete incongruence between the bacterial findings in the sputum and those of the pleural effusion, even if there is a definite perforation of the abscess. As a rule the pleural complications set in when the disease has persisted for from 1 to 3 weeks.

The treatment has primarily been directed against the pleural complication, which has quickly been subjected to treatment, as a rule, by rib resection (a closed method) and suction drainage. In 8 cases pneumonotomy was performed at the same time for pleural drainage. Secondary operation was required in 8 cases.

Eight patients died in the department, 4 after discharge. One of the patients still has a small bronchial fistula, but the others (19) are well. The follow-up period ranges from 1 to 3 years. The prognosis is serious in patients already affected with a chronic disease of the lungs: it was chiefly such patients who died. Otherwise, pleural complications of pulmonary abscesses usually run a benign course with adequate drainage.

JOHN J. MALONEY, M.D.

The Treatment of Bronchiectasis (Tratamiento de las bronquiectasias). OSCAR J. CAMES. *An. cirug.* Rosario, 1947, 12: 335.

The author presents a general survey of the treatment of bronchiectasis. He points out the limitations of "medical" management and emphasizes the dismal outlook for untreated bronchiectasis. The justification for pulmonary resection in extirpating the bronchiectatic segments of lung is presented, as well as a consideration of the problems involved in bilateral bronchiectasis.

Brief reference is made to a personal series of 17 cases with 2 deaths. The bulk of the discussion, however, is based on material collected from authoritative sources.

HIRAM T. LANGSTON, M.D.

The Drawbacks Encountered in the Local Treatment of Pleural Empyema with Chemotherapeutic and Antibiotic Agents. JENS L. HANSEN. *Acta chir. scand.*, 1948, 96: 509.

In the local treatment of empyema, early and frequent punctures, aspiration of the pus, and intrapleural injection of chemotherapeutic and antibiotic agents in large doses are of great value during the first stage of the disease. In nontuberculous cases this treatment should, however, be replaced by permanent drainage, if freedom from symptoms, a clear thoracic field, and a fully expanded lung on the x-ray film are not obtained quickly. It depends to a great extent on the care and thoroughness with which the treatment is carried out as to how long puncture treatment is sufficient and which patients require insertion of a drain. There is hardly any doubt that a few specially trained and enthusiastic therapeutists are capable of curing many patients with empyema by the puncture method alone.

However, this form of therapy is particularly exacting, and during the later stages of empyema it is far more difficult than drainage. Moreover, it entails no small risk. It must, therefore, be considered a fact that during the later stages of empyema permanent drainage affords the best chances of cure. One runs a greater risk in leaving even sterile pus and fibrin in the pleural cavity than in establishing drainage. As the result of local treatment, operation can now, as a rule, be put off to a time when it practically involves no risk.

In tuberculous empyemas of the mixed infection type it is advisable to prolong the course of punctures and injections.

JOHN J. MALONEY, M.D.

Intrapleural Penicillin in the Treatment of Acute Nontuberculous Empyema Thoracis (La penicilina intrapleural en el tratamiento del empiema pleural agudo no tuberculoso). R. VALDIVIESO, G. SEPÚLVEDA, and R. RAMÍREZ. *Rev. med. Chile*, 1948, 76: 185.

The present report covers the authors' experience with 30 cases of acute nontuberculous empyema in

patients treated with penicillin administered intrapleurally. There were 20 adults and 10 children in the series.

In 27 patients, the pleural process was believed to have followed acute lung disease. Three cases represented traumatic hemothoraces that became secondarily infected. A pneumococcus was the infecting agent in 53.3 per cent of the cases, a streptococcus in 6.6 per cent, and a staphylococcus in another 6.6 per cent. In 9 cases the pleural fluid was sterile when first seen. In 6 of these 9 patients, however, penicillin had been administered previously. The average total dosage per patient was 450,000 units. The pleural fluid became sterile after from 1 to 3 instillations, although as high as 26 thoracenteses were required in one instance to complete the treatment. Sterilization of the pleural fluid alone was not considered an indication to cease treatment, and caution against too early suspension of therapy is sounded.

Penicillin was given systemically in addition to the intrapleural dose to the majority of patients because of the lung pathology or the advent of some complication.

Only one case is admitted to have become chronic. The follow-up on the majority of the remaining patients had been of 2 to 3 months' duration and they are reported as being well. The duration of the illness up to the time of discharge, however, ranged from 32 days to 170 days, 8 of these patients having spent 90 or more days in the hospital, and 17 of them 60 or more days.

The data furnished is essentially statistical. No documentation by roentgenography is offered.

HIRAM T. LANGSTON, M.D.

HEART AND PERICARDIUM

Anomalies of the Derivatives of the Aortic Arch System. JESSE E. EDWARDS. *Med. Clin. N. America*, 1948, 32: 925.

The primary purpose of this communication is to describe and to illustrate those anomalies of the derivatives of the aortic arch system which may interfere with the function of either the esophagus or the trachea. The subjects of persistent patent ductus arteriosus and coarctation of the aorta are not included. The majority of the anomalous configurations presented have been described. To these were added several configurations which, as far as the author knows, had not been reported heretofore. They stand out as distinct possibilities and, consequently, were included as hypothetical forms. This was done with the hope that when they are encountered they will be understood and not be viewed with undue surprise. Furthermore, it is hoped that whoever observes these hypothetical possibilities will be stimulated to place them on record in order that the literature may contain a more comprehensive accumulation of this group of anomalies.

It is customary to employ the standard Rathke diagram of the six aortic arches in explaining the developmental basis for the various anomalies of the aortic arches, and in relating the various types to each other. While this approach is perfectly logical and correct, the reader, nevertheless, is likely to be somewhat confused. In the basic diagram of the six aortic arches, which is customarily employed, the subclavian arteries lie caudad to the sixth arches. Yet, by the time of birth, important differences in the rates of growth of the portions of the aortic arch system result in the presence of the subclavian arteries in a cephalad position with respect to the sixth aortic arches.

The author believes that a better understanding of the relationship of the aortic arch anomalies, from a developmental point of view and with respect to each other, can be had by an approach other than the employment of the basic primitive and diagrammatic six-arch pattern. To the author, it seems best to employ as the basic pattern an anomaly which, while it contains the essential features of the primitive aortic arch pattern, has also gone through the growth adjustments that take place in all persons.

The anomaly known as the functioning double aortic arch is chosen as the basic pattern. To fulfill completely the line of reasoning, this anomaly should contain right and left ducti arteriosi, but usually only one ductus arteriosus is present. The one adjustment that the reader must make is to realize that the functioning double aortic arch represents, with one exception, the primitive aortic arch pattern, in which growth adjustments have taken place. The exception is that one of the sixth aortic arches has largely disappeared.

In the author's opinion, malformations of the aortic arch derivatives may be divided into two groups, depending upon whether the ductus arteriosus takes its origin from the left pulmonary artery or from the right pulmonary artery. These groups are explained at length in the author's paper. Arbitrarily, in cases in which the ductus arteriosus arises from the left pulmonary artery, the anomalies are classified under group 1, while in cases in which the ductus arteriosus takes its origin from the right pulmonary artery the anomalies are placed in group 2. Group 1 is by far the larger of the two. Although exceptions to the rule occur, the upper portion of the descending aorta lies on that side of the body on which the ductus arteriosus is found.

In those cases in which the upper portion of the descending aorta lies on the right side, the lower portion of the descending aorta crosses to the left at about the level of the body of the eighth or ninth thoracic vertebra to leave the thorax through the aortic hiatus.

If a patient suffers from symptoms resulting from an anomaly of the derivatives of the aortic arch system, certain rules concerning surgical therapy can usually be followed. Relief may be obtained by division of the smaller of the two aortic arches, by division of that part of the arch which is atretic, by division of the ductus arteriosus, by dislocation of a common carotid artery, or by division of a subcla-

vian artery. Usually, the structure or structures which must be treated surgically are either the ductus arteriosus or some structure which lies in the same side of the body as the ductus; therefore, it is advantageous for the surgeon to know, preoperatively, on which side the ductus arteriosus lies in order that he may perform the thoracotomy on that side. Since the roentgenologist is not able to visualize the ductus arteriosus directly, he must rely on indirect evidence in predicting its situation. The following rule, although not infallible, will be helpful. The ductus arteriosus usually lies on the same side of the thorax as does the upper portion of the descending aorta. By visualizing the site of the latter structure, the roentgenologist may predict, with reasonable accuracy, the situation of the ductus arteriosus and guide the surgeon as to the proper side on which to perform the thoracotomy.

ESOPHAGUS AND MEDIASTINUM

Combined Left Abdominal and Right Thoracic Approach to Resection of Esophageal Neoplasms. JOSEPH E. MACMANUS. *Surgery*, 1948, 24: 9.

Progress in surgical therapy of neoplasms of the esophagus may be attributed to several factors: improved anesthesia, more adequate preparation, improved antibiotic therapy, more adequate blood replacement, and increased knowledge of thoracic surgery.

The author mentions a few disadvantages to the left transthoracic and thoracoabdominal approaches. The patient may be subjected to a major procedure in the thorax, only to find that the lesion has involved the liver. Also, there is a tendency to compromise the amount of tissue resected on the proximal side of the neoplasm. Disturbed physiology results from pulmonary and cardiac reflexes. In the middle third lesions, involvement of the right mediastinal pleura and azygos vein makes the procedure more hazardous from the left side. Crushing of the phrenic nerve results in difficulty with identifying collections of fluid in this area, favors the development of atelectasis, and diminishes tussive power.

In developing his technique, the author made two cadaver dissections, and later performed the procedure on 2 patients. He believes that the procedure was technically less tedious, was adequate as a cancer operation, preserved both phrenic nerves, minimized the incision in the diaphragm, facilitated adequate excision of tissue proximal to the lesion, obviated some of the difficulty encountered at the aortic arch, was less traumatic, and consumed less time. The author states that this is not an original procedure since Ivor Lewis had already reported its use.

The operative procedure consists of two stages. In the first stage the abdomen is opened to the left of the midline and explored. The gastrocolic ligament is divided, and dissection is continued by division of the left gastroepiploic artery and the vasa brevia. The left gastric artery is divided close to its origin. The gastrohepatic mesentery is divided to the diaphragm. The peritoneal reflexion from diaphragm to esophagus is severed. The technique differs from that of Lewis in that the right crus of the diaphragm is sectioned. At this point care must be taken not to injure the thoracic duct or the right inferior phrenic artery. The esophagus is freed from the mediastinum for about 2 inches, and the abdomen is closed.

In the second stage of the operation the right chest is opened through the bed of the fifth, sixth, seventh, or eighth rib, depending upon the level of the lesion. The mediastinal pleura is opened from 3 inches above the lesion inferiorly to the diaphragm. Local invasion of the lung root, the vertebral bodies, and the aorta are most frequently the cause of inoperability. When operability has been established and the esophagus has been freed, the stomach is delivered into the chest, and the nodes about the cardia are dissected away and left on the specimen. The stomach is cut across near its junction with the esophagus, and the stomach is closed with three rows of sutures. The stomach is then sutured to the esophagus with one row of interrupted sutures, and the esophagus is transected, one clamp only being used, and this on the distal side. The point of section is preferably 3 inches proximal to the lesion, because of the tendency of wide submucosal spread. Interrupted silk is used in two rows for the anastomosis. The stomach is sutured to the diaphragm and mediastinal pleura. Intercostal drainage is used for 48 hours.

Since acceptance of the article for publication, 5 additional resections have been done by this method.

ROBERT E. FLORER, M.D.

Syndrome of Pancoast-Tobias in a Case of Primitive Carcinoma of the Esophagus (Sindrome di Pancoast-Tobias da carcinoma primitivo esophageo). M. BANCHE. *Minerva med.*, Tor., 1948, 39: 615.

The 52 year old male was a sort of maverick, wandering about without family or means of support; he was admitted to the hospital in a confused mental condition and remained there under observation until he died, 5 days later.

When first observed, the patient stated that his symptoms had begun to develop about 3 months previously. He exhibited a massive edema of the entire right upper extremity, right upper third of the thorax and the right shoulder, and right side of the neck and face. About the root of the arc and over the shoulder and upper chest were an evident compensatory venous congestion and dilatation. There was a typical Horner's syndrome of the right eye, and paralysis of the right recurrent nerve (paralysis of the right vocal cord). The physical findings and roentgenological examination demonstrated massive involvement, apparently filling the right thoracic cupula and producing pressure of the second and third ribs on the right side. Fever was irregular and the patient constantly complained of pains in the right arm, and latterly of headaches.

Autopsy disclosed an atypical pavement epithelial carcinoma of the upper third of the esophagus

which had sprouted out into the right lung and spread into the right apical region of the chest, displacing downward and compressing the pulmonary tissues of the apex of the lung. The process had metastasized to the mediastinal and supraclavicular lymph nodes, apparently on both sides of the neck and to the liver.

In the author's opinion, this case of esophageal cancer, verified at autopsy, demonstrates that any sort of tumor of the upper mediastinum, primitive or metastatic, is capable of producing a complete Pancoast-Tobias syndrome without reference to a primitive or metastatic malignant tumor within the parenchyma of the lung itself (upper lobe tumor of Pancoast). JOHN W. BRENNAN, M.D.

Fibroma of the Mediastinum with the Syndrome of Pancoast (Fibroma del mediastino con sindrome di Pancoast). F. MARCOLONGO and P. C. FERABOLI. *Minerva med.*, Tor., 1948, 39: 612.

The authors report the case of a 27 year old female who at 11 years of age had noted a weakening and atrophy of the left upper extremity, which was especially evident in the hand. At about this time there appeared engorgement of the veins at the root of this arm and also at the base of the neck. This condition gradually became worse, without, however, the development of any other symptoms worthy of note. A year previous to the time the patient was first observed, a ptosis of the left upper eyelid developed, and only a month previously there appeared a sudden burning pain extending downward along the left arm. At this time there appeared an irregular fever oscillating from 38° to 39° centigrade, and the patient gradually lost 10 kgm. in weight. At examination the patient presented in addition some anemia, and the roentgen examination disclosed a solid-appearing sharply delimited tumor in the upper region of the left thorax which extended from the plane of the vertebral column, which was pushed to the right, out to the left axilla. There was some enlargement of the left axillary lymph nodes and a dense homogeneous mass which was painful to pressure. A biopsy specimen from this mass disclosed, histologically, a simple fibroma. Pulsus differens and a difference in the blood pressure measurements on the two sides (left, 80/50; right, 115/65) were present.

Through an ample thoracotomy (third, fourth and fifth ribs) the mass was successfully removed; however, after a period of 2 days the patient began to exhibit symptoms of collapse, and she died on the fifth day after the operation. At autopsy, degenerative signs were observed in the liver and kidneys, and a brown atrophy of the myocardium was present. The tumor mass, which was 14 by 10 cm. in size, proved again to be a fibroma without admixture of other tissues. There were extensive necrotic areas involving the medial and anterior portions of the tumor.

The author designates the symptoms here present as a Pancoast syndrome, although when that author described the condition in 1924 he intended it to apply only to malignant tumors of the pulmonary apex. It is believed that this is the first of these tumors to be diagnosed preoperatively.

JOHN W. BRENNAN, M.D.

MISCELLANEOUS

A Study of Intrathoracic Cysts Arising from the Diaphragm. P. E. A. NYLANDER and S. J. VIIKARI. *Ann. chir. gyn. fenn.*, 1948, 37: 99.

Three cases of cysts in close relation with the diaphragm and located near the pericardium are reported. These cysts varied in size from that of a goose egg to one which was 23 by 13 cm. in size. Hystologically, the cysts were similar in that there was a firm inner layer and a dense outer layer, the outer layer being more vascular. One cyst was lined by endothelial epithelium. All cysts were removed surgically.

In discussing the origin of these cysts, the authors point out that in their 3 cases the location was in the ventral median part of the right half of the diaphragm. They believe that Broman's investigations throw some light on the origin of these cysts. According to Broman, the bursa infracardiaca is a remnant of the right pneumatoenteric recess developed from the original pleuroperitoneal celomic cavity. The cranial part of the original recess becomes isolated and remains, as a bursa infracardiaca, between the esophagus, the right lung, and the right half of the diaphragm. There are 2 bursae at first, on both sides of the esophagus, but the left one usually becomes atrophied. In some mammals this structure is larger than in man, and the size varies greatly. Therefore, it would seem natural for a bursa to persist as a cyst. In diagnosis, roentgenology is the most helpful method. In one case the author used a diagnostic pneumothorax. Bronchoscopy and bronchography are not particularly useful in diagnosis of these cysts. Treatment of these cases is operative.

ROBERT E. FLORER, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Peritoneal Reaction to Oxidized Cellulose. EUGENE T. DMYTRYK. *Arch. Surg.*, 1948, 56: 386.

Oxidized cellulose has recently been added to the armamentarium of the surgeon, a gauzelike material which is completely absorbed in the tissues and serous cavities. Its physical and chemical properties have already been described in the literature.

There has always been some concern expressed about leaving nonabsorbable materials in the tissues and especially in the serous cavities. Nonabsorbable sutures such as silk, cotton, or nylon may be left in the tissues and serous cavities with a certain degree of impunity. Gauze sponges and packs have been left in the serous cavities with untoward results such as empyema, fistula formation, and intestinal obstruction. They have also been left in the serous cavities for hemostasis, and when they have been removed hemorrhage has often recurred or infection has been introduced.

The use of oxidized cellulose with thrombin as a hemostatic agent has been studied. A specific hemostatic action of its own, which is due to the formation of a coagulum consisting of salts of cellulosic acid and hemoglobin, was observed. Oxidized cellulose has an untoward effect in bone. There is a delay in early callus formation in fractures which is due to the acidity of the gauze.

The primary reaction of traumatized peritoneum to oxidized cellulose is a fibroblastic proliferation.

The connective tissue becomes flattened to produce a lining membrane.

Adhesions are formed between the omentum and intestine and the adjacent segments of intestine.

The adhesions are permanent and are present after complete absorption of the oxidized cellulose.

The adhesions observed after immediate application of oxidized cellulose to the traumatized serosa are finer and less numerous.

The recurrence of adhesions cannot be prevented by oxidized cellulose. HARRY W. FINK, M.D.

Contribution to the Study of Pneumococcic Peritonitis (Contributo allo studio della peritonite pneumococcica). GINO TARTARINI. *Arch. ital. chir.*, 1947, 69: 311.

The problem of pneumococcic peritonitis, in spite of numerous contributions to the literature, based on study, experience, and research, has not been solved. The differential diagnosis between pneumococcic peritonitis and the crisis of acute appendicitis still creates a "therapeutic dilemma." Whether surgical intervention as an emergency measure should be attempted in cases of pneumococcic peritonitis, as in other types of septic peritonitis, or whether it should be delayed or even advised against, is still a debated question.

After discussing the etiology, pathogenesis, pathological anatomy, symptomatology, diagnosis, prognosis, and treatment of pneumococcic peritonitis, the author painstakingly reports the clinical history of 7 cases of pneumococcic peritonitis which occurred among a series of patients operated on in the Civilian Hospital of La Spezia.

The condition occurred in children, all girls, of from 3 to 11 years of age. The disease is more common in children than in adults, and is observed in girls more often than in boys. In 3 of the 7 cases the peritonitis was diffuse, and in the remaining 4 the peritonitis was localized.

The first case was that of a girl of 9 years, who was admitted to the hospital with a diagnosis of acute appendicitis. Physical examination revealed the presence of diffuse abdominal pain, unaccompanied by muscular spasm. Examination of the lungs was negative. The patient suffered a severe persistent diarrhea which had been present since the onset of the disease; vomiting was present, but not marked. Pneumococcic peritonitis was considered in differential diagnosis, but there was absence of labial herpes, vulvitis, and other extra-abdominal signs of the disease. Exploratory puncture was not made. Leucocytosis was present (20,500 white blood count with 92 per cent polymorphonuclear neutrophiles). After a stormy period of remittent fever, the patient developed signs of a localized abscess above the umbilicus. On the fifteenth day of the disease a midline incision above the umbilicus was made with the discovery of purulent peritonitis, in the evacuated pus from which was identified the pneumococcus. Drainage was instituted and recovery was gradual. In the author's opinion, a diagnosis of acute appendicitis was not justified in this case. The abdominal pain, which was diffuse, never became localized in the right lower quadrant. It was unaccompanied by muscular spasm on palpation. From the onset of the disease the patient suffered a persistent diarrhea, a symptom which is rarely prominent in patients with appendicitis. Diarrhea occurs chiefly in those cases in which the appendix lies within the pelvis, and it is not persistent or particularly severe. Vomiting was present, but not characteristic of that accompanying appendicitis. When signs of a localized abscess did appear, the localization was above the umbilicus.

The second case occurred in a girl of 4 years. The onset of the condition was accompanied by fever and persistent cough with scant expectoration. Bilateral bronchopneumonia was found in an x-ray examination of the chest. On the fourth day after the child's entry into the hospital, a painful swelling unaccompanied by muscular spasm appeared in the abdomen. Diarrhea was present and vomiting occurred only once. Tuberculous peritonitis was considered as the diagnosis. Two days later a swelling appeared over

the right trochanter. On exploratory puncture of the abscess, the pus obtained revealed gram-positive diplococci. Operation on the fifteenth day of the disease through a midline incision below the umbilicus revealed a pneumococcic peritonitis, the causative agent being proved by bacteriological examination of exudate from the abdominal cavity. Drainage was instituted; the trochanteric abscess was also drained. Recovery was gradual.

The third case of pneumococcic peritonitis occurred in a girl of 3 years, who was first admitted to the pediatric service for the treatment for worms. After some improvement following treatment, she developed a diarrhea, remittent fever, and diffuse abdominal pain. She was then transferred to the surgical service. Examination of the chest was negative; the throat was inflamed. The following day the fever subsided, the diarrhea was checked, and meteorism with a soft abdomen appeared. Pneumococcic peritonitis was suspected and a positive blood culture was obtained. A localized abscess developed in the region of the umbilicus. On the sixteenth day, operation was performed with drainage of the abscess. Recovery was gradual. This was a classical case of pneumococcic peritonitis with typical onset; intestinal signs with peritoneal invasion, diarrhea, diffuse abdominal pain, remittent fever, soft abdomen, subsiding pain followed by meteorism, a positive blood culture, and signs of the development of a localized abscess in the second week. Operation on the seventeenth day revealed a circumscribed abscess below the umbilicus. Pneumococci were present in the purulent exudate from the abdomen. Recovery was gradual.

The fourth case occurred in a girl of 7 years, who was admitted to the hospital with a fever, thready pulse, intense dyspnea, extreme abdominal pain, parched tongue, sunken eyes, but with no herpes or vulvitis. Examination of the chest and respiratory tract was negative. The abdomen was distended and diffuse abdominal pain was present on palpation. After hospitalization for 3 or 4 days, some improvement was noticed; then signs of a diffuse peritonitis appeared. Operation was performed with findings of a diffuse peritonitis which was due to the pneumococcus. Drainage was instituted. The patient died a few hours after intervention.

The fifth case was that of a girl of 8 years, who entered the hospital for the relief of severe pain in the lower quadrant and fever. Prior to entry she had been troubled with meteorism and constipation. She had been purged. Physical examination revealed a patient with flushed facies, a negative thorax, diffuse abdominal pain, more marked in the right lower quadrant and accompanied by slight muscular spasm in this region. There was present a vulvitis, but there were no organisms demonstrable in the vaginal secretions. Blood examination revealed a leucocytosis of 22,500, but the blood culture was negative. On the eighth day of the disease, operation was performed through a right rectus incision. A small amount of purulent exudate exuded from the wound. The appendix was inflamed. An appendectomy was done and drainage instituted. The exudate showed pneumococci. Recovery was gradual.

The sixth case was that of a girl of 11 years, who entered the hospital for the relief of abdominal pain, nausea, and fever. After her entry these symptoms began to subside and a diarrhea developed. A few days later an umbilical fistula developed spontaneously, through which exudate from a supposedly localized abscess flowed. Operation through a midline incision below the umbilicus was performed and drainage of a diffuse peritonitis was done. The causative agent was proved to be the pneumococcus. Recovery was gradual, with the development of an umbilical hernia which was later repaired.

The seventh case was that of a girl of 10 years, who was admitted to the pediatric service with a diagnosis of gastroenteritis. She had a past history of chronic indigestion. Five days before entry she had developed violent abdominal pain, vomiting, and diarrhea. These symptoms abated and a localized abscess beneath the umbilicus developed. A blood culture was positive for pneumococcus. Drainage of the peritonitis was carried out on the nineteenth day and recovery was gradual.

The author concludes from these cases that herpes labialis is not a constant sign of this disease and that it is difficult to demonstrate the presence of the pneumococcus in the blood and vaginal secretions. He considers the presence of vulvitis to be a very good presumptive sign, and that the most important diagnostic element is diarrhea which is persistent, tenacious, and initial. In all cases there is a severe onset with remittent fever, and acute diffuse abdominal pain unaccompanied by muscular spasm.

The possibility of an early diagnosis of pneumococcic peritonitis depends upon the recognition in female children of the presumptive signs of herpes labialis, vulvitis, catarrhal inflammation of the respiratory tract, abrupt initial high fever with rapid remission, diarrhea, vomiting, and diffuse abdominal pain unaccompanied by muscular spasm. To differentiate the condition from the onset of acute appendicitis is difficult. On account of this last fact, intervention is indicated immediately by many writers. The author recommends temporary supportive measures during the first 24 to 48 hours, until either the abdominal pain localizes or the acute initial symptoms begin to subside. In cases of circumscribed peritonitis, he advises prompt drainage of the abscess; in diffuse peritonitis, he advises waiting until localization of the abscess occurs.

The author advocates general anesthesia except in cases in which the general condition of the patient is very grave. Under these conditions, local anesthesia is advocated. In all cases he advocates simple drainage without appendectomy. A midline incision above or below the umbilicus is employed, depending upon the accessibility of the most dependent point of drainage of the abscess.

In the author's experience, biological treatment has not met with success. In grave cases he employs

serum therapy, sulfonamides, and penicillin with the hope of ameliorating symptoms and modifying the prognosis of the individual case.

BLACKWELL MARKHAM, M.D.

Stainless Steel Wire for Abdominal Incisions and Hernias. A. LAWRENCE ABEL AND ALAN H. HUNT. *Brit. M. J.*, 1948, 2: 379.

Stainless steel wire was introduced for the closure of abdominal incisions by Babcock in 1934. The authors consider that the elimination of postoperative disruption is one of the most compelling factors in choosing stainless steel wire rather than catgut, silk, or thread in the closure of abdominal incisions.

Abdominal disruption is due to one or more of the following causes: (1) failure of the biological processes of wound healing; (2) interference with healing, or the dissolution of recently healed tissues by a local infection or by digestive enzymes; and (3) a disruptive force such as vomiting, coughing, abdominal distention, hiccupping, or sneezing.

The strength of a wound correctly closed with stainless steel wire is unaffected by time, and is sufficient to withstand more than normal strains. It should therefore be used when there is any evidence of dietary deficiency, or when there is any factor present such as malignant disease or jaundice. Wound infection accelerates the dissolution of catgut and also prevents normal healing. The same effects are presented by wounds bathed with biliary, pancreatic, or other digestive ferments. If nonabsorbable ligatures such as thread and silk are used, infection penetrates into the interstices between the filaments of the material and cannot be thrown off by the body until the ligatures have themselves been discharged. Stainless steel wire is a single inert filament offering no concealment or retreat for micro-organisms. No matter how serious an infection is present, granulation tissue grows on the surface of the wire, closing in over it without any residual pocket. The wire is heat sterilized, and there is no risk of introducing infection. The strength of stainless steel wire is such that no disruptive force can burst a wound which is closed in one of the manners suggested. The risk of abdominal disruption can be ignored. Confidence in the abdominal closure is easily transmitted to the patient, who is thus more likely to co-operate willingly in getting out of bed within or about 24 hours after the abdominal operation.

The authors' experience dates from 1938 when wire sutures were adopted for the closure of all abdominal wounds, especially in the presence of potential infection and in cases of malignant disease. This practice was later extended to the repair of large incisional hernias and to other types of hernias requiring reinforcement of the defect. Thus far, stainless steel wire sutures have been used in more than 2,500 major abdominal incisions in seriously debilitated individuals without a single instance of abdominal disruption or postoperative herniation. In the past 4 years more than 300 hernial repairs have been made with stainless wire sutures.

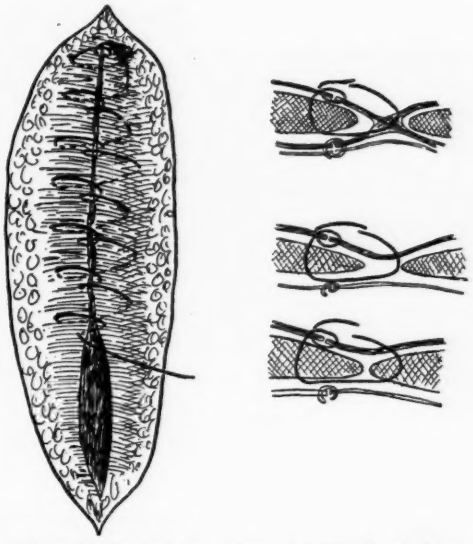

Fig. 1. To illustrate the closure of paramedian incisions, the wire being retained.

Stainless steel alloy wire is not ionizable in the body fluids. The tissues react to its presence by the formation of fibrous tissue, but no inflammatory or foreign-body response occurs. The wire acts as a framework over which the body deposits a dense mat of fibrous tissue over a narrow zone; the scar does not stretch. The wire suture does not act as an impediment to the healing of wounds infected at the time of operation or later.

In using wire sutures 2 principles must be adhered to. The anatomical relations of the parts sutured must not be distorted. Distortion implies tension, and tension leads to tissue necrosis. Stainless steel sutures must therefore be laid in the tissues without tension. The dissection prior to suturing or darning need involve only the immediate vicinity of the defect concerned. Fascial planes are thus not disturbed beyond a limited definition of the tissues, and, secondly, the wire must never be kinked. It will break at a kink. Care must therefore be used in all the processes of handling the wire, as well as in its introduction into the tissues.

The first complete stitch is passed through the tissues and the wire tied in a close reef-knot so that the suture is taut but not tight. The short end is then gripped against the knot with a pair of artery forceps, cut level with the blade of the forceps, and the stump twisted 180 degrees into the adjacent tissue. In thin subjects with little subcutaneous tissue it is advisable to cut the loose end of the wire flush with the knot.

In abdominal incisions of patients of normal build, the peritoneum together with the posterior

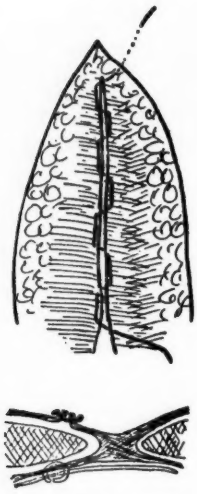

Fig. 2. To illustrate the closure of paramedian incisions when the wire is to be removed.

rectus sheath above the semilunar fold of Douglas is closed with a continuous catgut stitch in the usual manner. The muscle and the anterior sheath are then closed with a running figure-of-eight stitch (Fig. 1.) In thin patients it is better to use interrupted sutures and to cut each wire flush with the knot or to use an alternative method as illustrated in Figure 2.

The technique of closure of hernial defects is described.

With little experience, wire sutures can be handled with ease. Speed comes with practice. In respect to tensile strength, holding power, absence of inflammatory and foreign-body reaction, rapidity of healing, and to reduction of complications in an infected wound, stainless steel is better than catgut, linen or cotton thread, or silk. Tantalum wire induces the same favorable response on the part of the tissues. It is easier to use and has less tendency to kink than stainless steel. It is, however, not as strong and is more brittle in the knot.

In about 1 case in every 200 a broken end of wire causes discomfort to the patient and needs to be removed under local anesthesia. This trouble has occurred in midline and paramedian abdominal closures in thin patients. In no case has the wire, or a fragment of it, burrowed into the tissues more deeply and caused trouble.

The reopening of an abdominal incision closed with wire takes a little longer than that of one in which catgut or thread has been used but the method is easy. The skin and subcutaneous tissues are incised down to the wire loops. These are then defined sufficiently to be pulled up and divided between artery forceps, and the separate segments are then pulled out, care being taken to remove the whole wire. The knife blade used for this part of the incision is rendered useless for further work. There is no difficulty in closing a wound with wire for a second time.

ROBERT TURELL, M.D.

The Surgical Treatment of Strangulated Obturator Hernia (A proposito del trattamento chirurgies dell'ernia otturatoria strozzata). VITTORIO PETTINARI. *Ann. ital. chir.*, 1948, 25: 1.

The author describes the surgical treatment of obturator hernia, using the external approach. An ample incision is made along the adductor muscles parallel to the gracilis muscle, and the thigh is kept in flexion on the pelvis in abduction and external rotation, with the heel resting on the opposite knee; the pectineus muscle is then cut near the pubic insertion and retracted distally. To attempt to go through the muscle would interfere with proper exposure, especially in the case of a strangulated hernia. The superior border of the obturator foramen must be properly exposed and in order to accomplish this, Gimbernat's ligament and the crural arch are exposed. The latter is sectioned at the junction of the middle and medial thirds and the obturator foramen is thus exposed. The hernial sac is then opened, and the hernia is reduced. In the event that it is necessary to resect the bowel or exposure is not sufficient, one may extend the incision at the crural arch and then enter the peritoneal cavity and treat the hernial content in the best possible manner.

Repair of the hernia is made by the sectioned crural ligament which is transposed to cover the obturator foramen. The ligament is cut in such a way as to form a triangular limb, which is then turned down completely to cover the obturator foramen, and fixed with several sutures. Above this is sutured the pectineus muscle. In all these maneuvers, the obturator nerve is carefully guarded.

The author states that use of the sectioned crural arch is also made in the repair of inguinal hernia, with good results. As to the possibility of its causing a weakening of the anterior abdominal wall, the author believes this to be more theoretical than real. Moreover, the procedure is usually followed in the cases of older women in whom the danger of inguinal hernia is minimal since they do not, as a rule, perform heavy work.

The objections to the external approach, of those who favor the abdominal or internal approach, are discussed.

LUCIAN J. FRONDUTI, M.D.

GASTROINTESTINAL TRACT

The Relationship of Bone Trauma to the Development of Acute Gastroduodenal Lesions in Experimental Animals and in Man. STANLEY R. FRIESEN, K. ALVIN MERENDINO, IVAN D. BARONOFSKY, FREDERICK B. MEARS, and OWEN H. WANGENSTEEN. *Surgery*, 1948, 24: 134.

The mechanism of fat embolism following fracture, as stated by Warthin, is a release of liquid fat from

the marrow of the fracture site which gains entrance into the vascular system by virtue of increased tension at the site of injury, which forces the fat into the open veins of the bone. Most commonly, it is clinically important following fractures of the bones containing fatty marrow; less frequently, it is caused by injury to adipose tissue.

Of the numerous accounts of fat embolism of the lung, brain, and kidney following fracture, only occasional reference is made in the literature to the occurrence of embolic phenomena in the capillaries of the gastrointestinal tract. A small number of cases of gastroduodenal ulcerations following trauma to bone are cited from the literature. Virchow was one of the first to foster the theory of vascular blocking in the genesis of peptic ulcer. Lehman and Moore in 1927 presented experimental evidence suggesting a nontraumatic origin of fat embolism—the source of fat being the ultramicroscopic emulsion of fat in the normal blood plasma which may form fat droplets of emboli due to physical or chemical alterations in the blood.

The present study concerns the relative incidence of acute gastroduodenal ulcer or erosions complicating fractures and amputations of the long bones in patients dying early after fracture or amputation, and submitted to autopsy. The author also reports 2 cases in which the patients recovered following fracture. In addition, experimental evidence is presented concerning the occurrence of similar gastroduodenal lesions in animals subjected to operative fracture or the intravenous administration of nonemulsified fat.

Twenty-seven instances of acute gastroduodenal ulceration were observed among 1,432 cases of fresh fracture of the long bones coming to autopsy over a 24-year period, an incidence of 1.88 per cent. In well over one-half the cases collected, no clinical or pathologic diagnosis of fat embolism per se was noted or apparently looked for; however, in retrospect, the course of illness in each case is highly suggestive, a majority of patients having developed dyspnea, mental confusion, or oliguria, some with petechiae of the skin, hematemesis, or melena. Clinical diagnoses of acute ulcer, with institution of specific therapy, were made in 7 (24.1%) cases, 5 of which came to autopsy, and at this time the diagnosis was substantiated. The incidence of hemorrhage from the gastrointestinal tract in the cases presented was 58.6 per cent.

It should be mentioned that a great number of the patients submitted to autopsy died almost immediately following the injury, in too short a time for the occurrence of gastroduodenal ulceration from fat emboli. It has also been found that ulcers may be healed over in cases coming to autopsy late after fracture.

The production of gastroduodenal ulcers was attempted in a series of 91 dogs by drilling a hole through the cortices of both humeri, with and without curettement of the bone marrow or fracture. When these dogs were sacrificed after 21 days, 45 (49%) showed positive gastrointestinal ulceration. Ten showed ulcer and/or erosion of the stomach or duodenum (11%), one showed a perforated duodenal ulcer, and the remainder presented a mild to severe gastritis and/or duodenitis, with frequent evidence of hemorrhage from petechial bleeding points. The varied diets to which the dogs were subjected were found to be of no significance in the incidence of gastrointestinal disease in the different series of these dogs.

A group of 18 dogs received bilateral cortical fractures of both humeri and daily injections of histamine. When these dogs were sacrificed, 14 showed positive gastric or duodenal ulcers and 2 showed erosions of the mucous membrane. This shows that fracture causes an increase in the rate of ulcer occurrence in dogs which have been stimulated with histamine.

The gastric acidity of patients with fresh fractures was tested daily. Free and total values for gastric acidity showed no significant variation from the normal.

Another group of 6 dogs were subjected to gastric pouch operations and then received operative fractures of the humeri. Marked stimulation of gastric acidity and volume was produced in only 1 dog; the remaining 5 dogs showed no effect. Two dogs with gastric pouches also received an appendectomy and splenectomy, respectively. Neither of these dogs showed any stimulating effect on the gastric secretion from the operation.

A group of dogs, in which gastric secretion values for volume and acidity had been standardized by daily intubation, received operative fracture of the humerus. Postoperative tests of gastric acidity showed no increase in free acidity. This demonstrated that histamine liberation from the fracture site is not sufficient to cause the stimulation of gastric acidity necessary to produce a gastric or duodenal ulcer such as that which is found in patients with fresh fracture or in the experimental dogs subjected to operative fractures.

The intravenous injection of human fat into a group of dogs, rabbits, cats, and guinea pigs was carried out in conjunction with the injection of histamine-in-beeswax. This produced a high rate of bleeding gastric and duodenal ulcers. Four dogs possessing gastric pouches received single intravenous injections of fat and it was found that this did not stimulate nor augment gastric secretion.

Microscopic studies showed that 26.3 per cent of the experimental animals receiving intravenous fat injections revealed fat emboli in the stomach and duodenum. The stomachs of patients who died early after fractures of the long bones showed fat in 40 per cent. Fat was demonstrated in the submucosal and mucosal vessels of the stomach and duodenum. This supports the conclusion that the occurrence of gastroduodenal ulcer or erosions following fracture of long bones, or of both, is a concomitant of fat released from the site of fracture.

ERNEST D. BLOOMENTHAL, M.D.

The Lytic Action of Saliva on Gastric Mucin from Patients with Ulcer, in Relation to the Pathogenesis of Gastric Ulcer (Il potere litico della saliva degli ulcerosi sulla mucina gastrica in rapporto alla patogenesi dell'ulcera gastrica). PIETRO MAJONE. *Riforma med.*, 1948, 61: 297.

The author discusses the relation of gastric mucin to ulcer formation. It has a triple action: mechanical, chemical, and biological. Following his experiments on the action of saliva upon gastric mucin, he arrives at the following conclusions:

1. Gastric mucin in normal individuals, as well as in those with peptic ulcer, loses its viscosity in time, perhaps through the mucinase action of enzymes contained in the mucin itself.
2. The saliva of normal individuals has a minimal lytic, hence negligible, action upon their own gastric mucin, as well as upon the gastric mucin from patients with ulcer.
3. The saliva from patients with peptic ulcer possesses intensive lytic action upon normal gastric mucin as well as upon gastric mucin from patients with peptic ulcer, diminishing its viscosity.
4. The mucinolytic property is specific for saliva from patients with peptic ulcer.

In view of this data, the author believes that the protective action of gastric mucin is deficient in ulcer patients and this loss is due to the diminished viscosity of the mucin rather than upon a diminished quantity. This view is further substantiated by the fact that there is a difference of opinion as to the amount of mucin found in patients with peptic ulcer. Reference is made to different authors, some of whom maintain that gastric mucin is decreased while others maintain that gastric mucin is increased in patients with peptic ulcer.

LUCIAN J. FRONDUTI, M.D.

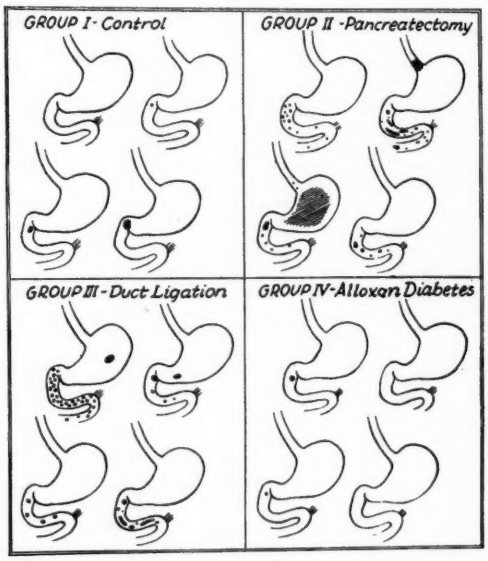

Fig. 1 (Poth *et al*). Schematic demonstrations of the extent and distribution of ulcerations caused by histamine-in-beeswax with the alterations of pancreatic status.

The Relation of Pancreatic Secretion to Peptic Ulcer Formation. Effect of Pancreatectomy, Ligation of Pancreatic Ducts, and Diabetes on the Production of Histamine-Induced Ulcers in the Dog. EDGAR J. POTH, LOUIS J. MANHOFF, JR., and A. WILLIAM DELOACH. *Surgery*, 1948, 24: 62.

The relationship between pancreatic secretion and peptic ulcer formation has been observed for some time. This relationship is now more important because of the advent of vagotomy and its possible modification of the effective parasympathetic innervation of the pancreas and the subsequent influence upon secretory activity. Duodenal ulcers may be produced by the deviation of the alkaline secretion of the pancreas through external fistulas, or the internal duodenoileal fistula, and by ligation of the pancreatic ducts. The occurrence of these ulcers has usually been considered the result of depriving the duodenum of the neutralizing influence of the bile and pancreatic secretions on the acid effluent from the stomach. When the duodenum is deprived of alkaline secretion by pancreatectomy, duodenal ulceration rarely supervenes. The difference may be that whenever the pancreas is present and the external secretions are excluded from the bowel in immediate contact with the gastric secretions, ulcers develop, while with simultaneous removal of the internal secretions by pancreatectomy, ulcers do not develop when the external secretions are excluded, because the blood sugar remains at a relatively high level without the stimulating effect of hypoglycemia on the acid secretion by the glands of the stomach.

Investigators have reported the incidence of experimental peptic ulcer following external pancreatic fistulas as being almost 100 per cent, following ligation of the ducts, 29 per cent, and following pancreatectomy, 1.3 per cent. It may appear that ulcer formation in these situations is not explained adequately by failure of neutralization in the duodenum of the acid effluent of the stomach by the diverted alkaline secretions, and the question is advanced whether the pancreas has an intrinsic influence upon ulcer formation other than that of mere alteration of the duodenal contents.

Statistical studies indicate that peptic ulcers develop infrequently in diabetic patients. From 20 per cent to 40 per cent of diabetic patients exhibit anacidity, which may be a related factor.

Both the internal and external secretions of the pancreas may be implicated in ulcer formation. This study concerns certain aspects of the influence of the secretory activity of the pancreas upon the formation of ulcers induced by continuous histamine stimulation of the dog.

Sixteen dogs were divided into groups of four. The controls were placed in group 1; dogs having

TABLE I*

Group	Animal No.	Weight in Kgm.	Days Histamine Administration	Bleeding	Perforation	Remarks†
1	3	10	44	0	0	Sacrificed, no ulceration present
	4	9	44	0	0	Sacrificed, one small duodenal ulcer
	11	6	13	0	0	Sacrificed, one small, superficial duodenal ulcer
	12	5	12	0	0	Sacrificed, one small ulcer at pylorus
2	1	7	7	+	0	Died, numerous ulcers of duodenum and proximal jejunum
	2	12	6	+	2	Died, extensive ulceration of duodenum and jejunum and erosion of mucosa of esophagus
	5	14	4	++	0	Sacrificed, multiple duodenal ulcers, 2 esophageal ulcers, extensive gastritis.
	6	11	6	+	1	Sacrificed, 4 duodenal ulcers, hemorrhage, from antrum of stomach
3	7	30‡	2	+	1	Died, extensive ulceration of duodenum and jejunum; one ulcer in stomach 3 cm. in diameter
	8	20	4	++	0	Sacrificed, multiple duodenal ulcers; an ulcer in antrum of stomach
	9	10	5	+	1	Died, 4 duodenal ulcers
	10	9	6	+	1	Died, multiple duodenal ulcers
4	A 8	9	12	0	0	Died, no ulceration present
	A 9	8.5	13	0	1	Died, one large perforated duodenal ulcer.
	A10	9.5	15	0	0	Died, no ulceration
	A12	5	10	0	0	Living, no evidence of ulcer

*These four groups of animals received 5 mgm. of histamine-in-beeswax intramuscularly per kilogram of body weight daily: Group 1, control experiments; Group 2, total extirpation of pancreas; Group 3, ligation of both pancreatic ducts, and Group 4, rendered diabetic by administration of alloxan.

†Summary of all lesions is given graphically in Fig. 1.

‡This animal received only 100 mgm. of histamine-in-beeswax daily.

total pancreatectomy comprised group 2; dogs in which the pancreatic ducts had been ligated comprised group 3; and dogs made diabetic by the administration of alloxan comprised group 4. All of the animals received similar intramuscular injections of histamine in beeswax, by the technique of Hay, Varco, Code, and Wangensteen.

A large series of dogs which had been pancreatectomized and maintained for a long period on a dietary regimen identical to this group, also at the Surgical Research Laboratory of the University of Texas, served as controls to demonstrate that ulcers do not develop spontaneously in these animals. Ligation of the pancreatic ducts was performed in 3 other dogs which were used as additional controls for group 3, and their sacrifice 2 months later showed that no ulcers had developed spontaneously. The milk and meat diet appeared to be adequate to protect against ulcer formation. Atrophy of all the pancreas except a thin cord of islet tissue indicated that complete blockage of the ducts was obtained.

The pancreas of the dogs in group 2 was totally extirpated by careful blunt dissection and the main duct ligated. Postoperatively, careful management and replacement therapy maintained these animals in good condition indefinitely. Milk and corn syrup after 12 hours, and ground, raw horse meat mixed with lecithin and pancreatin after 3 days constituted the diet. Two weeks postoperatively insulin was given and fasting blood sugar levels from 217 to 570 mgm. per cent indicated the completeness of the pancreatic extirpation. Histamine injections were not started until 2 weeks after operation.

The animals in group 3 had both pancreatic ducts isolated and cut between cotton ligatures. The pancreas was completely separated from the duodenum and a bit of omentum interposed. Postoperative care and feedings were the same as for the depancreatized animals, except that the administration of insulin was not necessary.

For the purpose of studying the effect of eliminating the action of insulin, the dogs in group 4 were made diabetic by the administration of 75 mgm. of alloxan per kilogram of body weight. The degenerative changes on beta cells by the action of alloxan are not readily accomplished in dogs, so it was necessary to withhold food for 72 hours to render the 4 animals diabetic. After stabilizing these animals on daily insulin therapy to maintain reasonable blood sugar levels on the standard milk and meat diet, daily injection of histamine-in-wax was started.

A dosage of 5 mgm. of histamine-in-beeswax per kilogram of body weight was administered daily. The animals were sacrificed when they showed signs

of having developed an ulcer, such as anorexia, vomiting, bloody stools, and ill appearance (Table I.).

The control dogs in group 1 were divided into two groups: 2 dogs received a dog biscuit diet and 2 received the standardized diet (meat and milk) fed to all animals included in this study. The 2 animals on the routine dog biscuit diet developed typical single ulcers in the first part of the duodenum. The 2 dogs on the standardized meat and milk diet showed no signs of ulcer development; they were sacrificed on the forty-fifth day and one had a single small duodenal ulcer and the other none. Apparently the meat and milk diet prevented ulceration in one dog and ameliorated it in the other.

In the depancreatized dogs (group 2), severe multiple ulceration of the duodenum developed within 4 to 7 days of histamine administration. Two of these animals died, 2 had perforations, and bleeding occurred in all 4 dogs.

Three of the 4 dogs with ligated pancreatic ducts, in group 3, died within 6 days. Three had perforations and all showed gross bleeding.

None of the animals with alloxan diabetes, in group 4, showed signs of ulcer formation. A single duodenal ulcer was present in one of the dogs.

These studies did not demonstrate that diabetes alters the tendency toward histamine-induced ulcer formation. No inhibitory effect on the formation of peptic ulcers was produced by the diabetic state. A point of practical significance derived from the experiments is that removal of the pancreas or ligation of its ducts, as is frequently performed in surgical procedure, is not without some danger of postoperative ulceration. It would seem advisable to reanastomose the pancreatic duct to the duodenum or jejunum whenever possible following resection of the head of the pancreas.

ERNEST D. BLOOMENTHAL, M.D.

Tumors of the Small Intestine. HOWARD A. WEINBERGER and RUDOLF M. PALTAUF. *Surgery*, 1948, 24: 35.

Tumors of the small bowel are rare in comparison to tumors which are situated at the extremities of the gastrointestinal tract. It is important to diagnose and treat tumors of the small bowel because they are extremely lethal.

In a span of 40 years, 20 primary tumors of the small bowel were discovered at the Lenox Hill Hospital in New York City. Ampullary tumors of the duodenum were omitted because they are probably of duct origin. During this period, 1,410 neoplasms of the gastrointestinal tract were observed, thus establishing a rate of 1 small bowel tumor to every 71 neoplasms elsewhere in the gastrointestinal tract.

Only 19 cases were available for study as the clinical record of one case was missing. Thirteen of the lesions were malignant and 6 were benign. The distribution between men and women was about equal. The average age of patients with benign tumors was 45 years and of patients with malignant tumors, 50 years.

Among the patients with malignant tumors, there was no instance of acute fulminating onset without preceding symptoms, and the average duration of symptoms here was 10 months (from 1½ to 48 months). In the group with benign tumors, the duration of symptoms varied from an acute fulminating onset, due to sudden intestinal obstruction, to a period of 36 months.

In patients with malignant tumors, usually the chief symptom was pain. This occurred in 9, or 70 per cent, of the 13 patients and was usually described as abdominal discomfort of an intermittent aching character. Six patients manifested bleeding and 4 complained of diarrhea, constipation, or alternation of the two. Weight loss, anorexia, and cachexia were present in 11 of the 13 patients. Seven exhibited obstructions, and in 5 there was a palpable mass.

Of the 6 patients with benign tumors, 4 complained of pain. Diarrhea and constipation were noted in 3 patients and bleeding occurred in 1 patient. Obstruction occurred in 3 cases and a mass was palpable in 3.

The symptoms varied from minor gastrointestinal distress to acute fulminating obstruction. Patients with persistent unexplained gastrointestinal complaints should be subjected to a careful roentgen examination of the small bowel pattern, as well as a roentgenological study of the remainder of the gastrointestinal tract. It may be necessary to resort to exploratory laparotomy.

In 6 instances of malignant and in 3 instances of benign tumors, x-ray studies were not made, usually because obstruction was present, or the patient was in extremis on admission. In the remaining 7 patients with malignant tumors, obstruction was demonstrable in 4 by roentgen examination. In one of these, obstruction was interpreted as due to neoplasm. Two of the 7 cases studied by x-ray examination exhibited what were interpreted as filling defects due to tumor.

In the 3 cases of benign tumors which were subjected to x-ray study, 1 tumor was registered as a negative examination, 1 as a mechanical obstruction of the ileum, and 1 as a filling defect. X-ray studies of the small bowel are generally not as satisfactory as those of the stomach or colon. Careful serial fluoroscopy and flash films of the small bowel following barium ingestion are essential.

The types of tumors encountered with their location, and the intussusceptions are listed in Table I.

It was interesting that 3 tumors of the duodenum were malignant and intussuscepted. Six tumors of the jejunum were malignant and 1 was benign and of these, 2 were intussuscepted. Four tumors of the ileum were malignant and 6 were benign, and half of each of these were intussuscepted. The fact that lymph node mestastases were largely concentrated in the large nodes at the root of the mesentery near the large mesenteric vessels made resection doubtful or impossible.

Ten of the 13 patients with malignant tumors were operated upon, 8 undergoing primary resection with

TABLE I. DEMONSTRATING DISTRIBUTION, PATHOLOGIC TYPES, AND FREQUENCY OF INTUSSUSCEPTION IN THIS SERIES OF SMALL BOWEL TUMORS

Small Bowel Segment		Pathologic Types	Total	Malignant Benign		→ Intussusception Malignant Benign	
	I			Carcinoma Melanosarcoma	2 1	3 Malignant→	0 Intussuscepted
Duodenum	II	Adenocarcinoma Melanosarcoma	2			0 Benign——→	0 Intussuscepted
	III	Adenocarcinoma	1				
Jejunum	I	Polyp Adenocarcinoma Small-celled carcinoma Leiomyosarcoma	4	Carcinoma Leiomyosarcoma	5 1	6 Malignant→	1 Intussuscepted
	II	Carcinoma Adenocarcinoma	2	Polyp	1	1 Benign——→	1 Intussuscepted
	III	Adenocarcinoma	1				
Ileum	I	Submucous fibroma Leiomyosarcoma	2	Carcinoma Lymphosarcoma Spindle-cell sarcoma Leiomyosarcoma	1 1 1 1	4 Malignant→	2 Intussuscepted
	II	Fibroma Spindle-cell sarcoma	2			6 Benign——→	3 Intussuscepted
		Submucous lipoma Pedunculated fibroma Intramural fibroma	6	Fibroma Lipoma Leiomyoma	4 4 1		
	III	Leiomyoma Adenocarcinoma Lymphosarcoma					
			20			13 Malignant→ 7 Benign——→	3 Intussuscepted 4 Intussuscepted

anastomosis. In this group, 3 deaths occurred in the immediate postoperative period, 2 from shock and 1 death from pneumonia. Four patients died of metastases, in 3 months, 18 months, 19 months, and 20 months, respectively, following resection. One patient with extensive ileocolic and rectal sarcomatosis was carried along favorably with deep x-ray therapy and was living and well 18 months after resection. Only 2 patients are living and entirely free of recurrence 18 months and 3 years, respectively, after resection. Both of these patients had resections for leiomyosarcoma. The 3 patients who were not operated upon died shortly after admission. Resection was performed in all 6 cases of benign tumors—side-to-side anastomosis being done in 5 cases and end-to-end anastomosis in 1 case. Three of the patients died—2 following operation and 1 in 6 months from an antecedent carcinoma of the cervix. The 3 remaining patients recovered and are well.

All patients with carcinoma succumbed because of the intrinsic malignant disease, which established the fact that with the present treatment of malignancies of the small bowel, the over-all prognosis is extremely discouraging.

An exhaustive review of the literature concerning tumors of the small bowel is presented and the 19 cases in this series are discussed in detail.

ERNEST D. BLOOMENTHAL, M.D.

Ileus in the Course of Acute Appendicitis (Ileus im Verlauf der akuten Appendicitis). GEORG SCHOENE. *Chirurg*, 1948, 19: 103.

Ileus may be the cause as well as a sequel of acute appendicitis. As an example of the first possibility the author refers to a case in which partial obstruction by a carcinoma of the ascending colon led to an acute appendicitis caused by the accumulation of feces. On the other hand, symptoms of a paralytic ileus can be produced in the very beginning of a severe attack of appendicitis without the presence of generalized peritonitis.

While these are comparatively rare occurrences, ileus is a frequent postoperative complication. It is of greatest importance for a correct prognosis and treatment to differentiate between paralytic and mechanical ileus although mixed forms of both types occur and may complicate the evaluation.

In most cases, paralytic ileus is a sign of generalized peritonitis. However, laparotomy often reveals that only a small part of the peritoneum is involved, in spite of a complete paralytic ileus. In such cases, early surgery may save the patient.

Mechanical ileus may be caused by adhesions, kinking or strangulation of a loop of the small intestine, or by volvulus or intussusception. These complications occur, as a rule, in a late stage of appendicitis, with or without operation.

As to the medical treatment, the author believes that the management of hypochloremia, dehydration, and acidosis is most important. Repeated large blood transfusions prove much more effective than saline and dextrose. In addition, the author recommends the administration of repeated hypertonic sodium chloride solutions intravenously (50 c.c. of a 9 to 10 per cent solution).

The patient should be operated upon as early as possible once the diagnosis of a mechanical ileus has been established. Many men are reluctant to operate a second time after appendectomy; however, the author believes that expectancy involves a much greater risk.

The author has had no experience of his own with the Miller-Abbott tube but stated that he believed this method should be tried preoperatively, either to remove the mechanical obstruction or, if this is not possible, to create better conditions for subsequent surgery.

The different surgical methods are discussed in detail. The question whether one should try to visualize and manipulate the obstruction, or whether one should confine oneself to a palliative operation (ileostomy) has been answered in different ways. In most cases ileostomy, proximal to the obstruction, is the operation of choice and gives good results provided the obstruction is not situated so high that there is danger of inanition. Only in rare cases is it advisable to perform at the same time an anastomosis between the ileum and colon.

WERNER M. SOLMITZ, M.D.

Conservative or Operative Management of Appendicitis in the Intermediate Stage? (Konservative oder operative Behandlung der Appendicitis im Intermediärstadium?). HELMUT GOEPEL. *Chirurg.*, 1948, 19: 59.

The present article is interesting particularly from the historical point of view, in that the question of the management of appendicitis before abscess formation is still a very serious problem in European countries where antibiotics are unavailable. The author considers the "intermediate stage" that period of about 48 hours following the onset of symptoms (in some cases 3 to 5 days) during which there is the widest variation in the course of acute appendicitis.

A favorable course during this period occurs when the appendix is protected in some way from the rest of the abdominal cavity, in which case either an inflammatory mass or an abscess ensues. An uncertain prognosis is given in the cases of those patients with a circumscribed peritonitis which may develop into a mass or an abscess, or may result in a diffuse peritonitis. A poor prognosis is given in those cases of generalized peritonitis which cannot be walled off.

The German literature of the past 20 years is reviewed and three schools of thought are represented. Kuemmell, Lexer, Kirschner, and Sudeck were advocates of operative management during this stage of appendicitis except in cases in which a frank walled-off abscess could be palpated. Goetze, Reschke, and Payr took a middle stand and recommended operation during this stage unless the appendix was ruptured, in which event conservative treatment was advocated. The opinions of these authors varied slightly with regard to the time limit, Reschke suggesting 48 hours while Payr waited 3 days. A third school, consisting mainly of Jungbluth and Narath, was considered the conservative group since they operated only on acute appendicitis without perforation, leaving all other cases for conservative management.

After an extensive review of the mortality statistics from various European clinics, which indicate that the mortality among patients operated upon rises sharply after the first 48 hours, the author arrives at the following conclusions:

Every acutely inflamed appendix should be removed within 48 hours of the onset of symptoms. Between 48 hours and 3 days the therapy varies from case to case. If the appendix is not yet perforated, it is removed. If there is an inflammatory mass, this is removed with the appendix. If there is a free-lying appendix with a purulent peritonitis, the appendix is removed and the peritoneal cavity is drained. If there is an inflammatory mass plus a purulent peritonitis, local drainage is done, and later, drainage through the pouch of Douglas. In some of these cases it is possible to remove the inflammatory mass and drain the area; in other cases technical difficulties may arise, in which instance a completely conservative nonoperative course is followed. Late in the intermediate stage (4 to 5 days) a nonoperative course is suggested. For the clinically late cases of appendicitis with abscess, conservative management is followed. In cases of diffuse peritonitis, operation may be done up to the end of the third day after the onset; after the fourth day conservative management is suggested. Interval appendectomy should be done in from 6 weeks to 3 months after the attack, depending upon the individual pathology.

It is interesting to note that the conservative therapy outlined by this author does not include the use of antibiotics while it does include such questionable therapeusis as peritonitis serum, adrenalin, and intravenous calcium. HAROLD LAUFMAN, M.D.

The Concept, "Mobile Cecum," and Its Surgical Management (Der Sammelbegriff "Cecum mobile" und seine chirurgische Behandlung). HERBERT JUNGHANNS. *Chirurg.*, 1947, 17-18: 580.

In the past forty years the clinical entity known as "mobile cecum" has acquired a large number of pseudonyms, and no less than 15 surgical procedures have been advocated for its correction. The purpose of this article is to point out by means of a review of the literature, as well as by diagrams, the many different varieties of mobile cecum.

The syndrome is usually one of long standing right lower quadrant pain with acute exacerbations un-

accompanied by the usual clinical and laboratory findings which would ordinarily be interpreted as acute appendicitis. In many of these cases the condition is diagnosed as appendicitis only to have the symptoms recur after appendectomy. Aside from the chronic type of pain there are usually audible borborygmi in the right lower quadrant, and a tumor mass can often be palpated. Careful roentgenographic and fluoroscopic studies will usually reveal the type of mobile cecum that is present.

Despite the many varieties of mobile cecum and the many confusing names heretofore applied, the author believes that all types should be called simply "mobile cecum," although the surgical approach to the various types need not be alike. The individualization, as far as surgery is concerned, will depend upon the pathology presenting itself. Procedures which have proved successful, depending upon the type of lesion present, are fixation to the lateral peritoneum, resection of the redundant portion of the cecum or entire right colon, and various types of side-to-side anastomoses, in order to prevent stagnation in the enlarged cecum.

If the surgeon is aware of the various procedures which might be utilized he will then be able to adjust his surgical approach to the pathology presenting itself, rather than be committed to a specific surgical procedure in each instance.

HAROLD LAUFMAN, M.D.

The Present-Day Therapy of Thromboulcerative (Streptococcal) Colitis. J. ARNOLD BARGEN. *Med. Clin. N. America*, 1948, 32: 967.

In the present article the author considers that form of ulcerative colitis which has its inception in the most distal portion of the rectum and spreads relentlessly orad from that point.

The author stated that treatment should rest on the convictions (1) that the condition is an infectious disease of the large intestine, (2) that uncomplicated cases constitute a medical problem, and (3) that certain complications are definite indications for operation.

Medical management of the patient includes rest and restful recreation, a diet adjusted to the needs of each patient, vitamins, vaccine, nursing care, drugs and antibiotics, oxygen, transfusions of blood, irrigations and instillations, removal of foci of infection, and parenteral administration of fluids.

The decision whether an operation should be performed is a common problem in these cases. Certain late sequelae of the disease present definite surgical problems. The principal ones are polyps, neoplasms, strictures, extensive perianal fistulas, localized perforations, and abscesses of one kind or another. Except for these and such essential operations as those for acute intercurrent surgical disease, surgical treatment should seldom be used. Ileostomy was found to be the procedure of choice.

When the disease has advanced so far that ileostomy is advisable, colectomy usually should be performed at a later date and as soon as the patient's condition warrants. In most cases it is well to postpone colectomy at least 6 or 8 weeks after the ileostomy.

Medical management should proceed after ileostomy in the same manner as before the operation, and if medical treatment is carried out carefully there will be a few cases in which colectomy will not be necessary and the ileac stoma can be closed with reasonable safety.

The patients without colons can live just as full and happy lives as those who have colons. No demonstrable physical deficiencies follow colectomy. It does not disturb the physiologic equilibrium of the body generally or of the chemical constituents of the blood, except temporarily. The terminal portion of the ileum becomes demonstrably, although not markedly, dilated after colectomy. A general diet can be taken. Special care of the ileac stoma becomes minimal. Patients are able to resume their economic and social activities. The same advice and precautions about overdoing and prevention of nerve tension, given to the patient whose condition is controlled by medical means, apply to all patients who have had thromboulcerative colitis. Occupations should be such that undue exposure to the elements and great expenditure of nervous energy are not needed and adequate physical and mental rest can be obtained.

There is analogy between the course of this disease and that of tuberculosis and every patient who has had a severe attack of ulcerative colitis is always a potential colitis patient. Relapses are common if the medical regimen is not followed assiduously. The most common causes of relapse are (1) infection of the upper part of the respiratory tract, (2) mental and physical trauma, and (3) the lighting up of distant foci of infection.

Colectomy in Ulcerative Colitis. SIR HUGH DEVINE and JOHN DEVINE. *Brit. M. J.*, 1948, 2: 127.

The results of surgical treatment in 11 desperate cases of ulcerative colitis are reported. A stage procedure is described in which each successive step in treatment was designed not only to bring about improvement but also to be a stage in the removal of the colon. An enterostomy was so planned that it was a step in the formation of an ileorectostomy. About 5 weeks later the ileum was connected to the rectum by the use of a special spur-clamp, and the open ends of the bowel taking part in the anastomosis were closed under local anesthesia. The colon, now isolated, with both ends forming two mucous fistulas, was completely out of action and was treated by routine chemotherapy over a period of months until the patient ceased to improve. Since there was no discharging enterostomy and the patient was comparatively comfortable, this period could be prolonged indefinitely until the patient was fit for the last stage, namely, colectomy.

In another case the ascending colon showed no evidence of the disease and was preserved and used as an artificial anus while the remainder of the colon

and rectum were resected in stages. Subtotal colectomy was also of value through the removal of much of the diseased colon.

Of the 11 patients, 2 died. One patient died of an adynamic ileus immediately following the first-stage modified enterostomy, and one died 3 months after the first stage from tissue deficiency and toxemia. None of the patients died following colectomy or excision of the rectum. Six patients seem to be cured, and the patient who had the worst case of all has been well for 6 years. They have no discomfort and lead normal lives.

Although the series is small, it includes such severe cases and such good results that the authors have built a future surgical policy based upon their experience. They believe that a case of established ulcerative colitis should come to a surgical consultation early in its course to consider the question of early operation from the following viewpoints:

1. Can the surgeon help the physician? He may be able to do so by making a nonleaking valvular appendicostomy.
2. There is some justification for the removal of the appendix, since it is not above suspicion as the point of entry of the infective element in the colitis.
3. To find out early in the course of the disease whether or not the ascending colon is free of the disease, because in this case the prognosis is much brighter and early operation is justifiable.
4. To ascertain the type and severity of the disease with a view to planning its treatment.

The author believes that judgment as to whether medical treatment will cure or not can be made. More attention to tissue resistance and tissue repair is advised, since they probably play a more important part in this infective disease than does the virulence of the organism. When ulceration and loss of substance of the mucosa have taken place and the physician is making no headway with his treatment, early operation with a view to removing the colon is advised. The reward of early colectomy or subtotal colectomy is a low immediate mortality and a good chance that the rectum will recover when the colon is removed. JOHN L. LINDQUIST, M.D.

Blastomycosis of the Anorectal Region. Considerations on 2 Cases (Blastomicose da região anoretal. Considerações sôbre dois casos). CARLOS DA SILVA LACAZ and EDISON DE OLIVEIRA. *Hospital*, Rio, 1948, 33: 845.

South American blastomycosis, improperly called Brazilian blastomycosis, rarely causes manifestations in the anorectal region. The lesions are usually localized in the buccopharynx, the lungs, the skin, and the lymph nodes. The portal of entry for Paracoccidioides brasiliensis, the agent of the mycosis, is generally at the buccopharyngeal or respiratory mucosa, exceptionally at the skin. The authors report 2 cases with involvement of the anorectal region; in one of them the condition was probably due to the use of vegetal leaves to cleanse the region after defecation.

In the first case, the lesions consisted of perianal ulcerations with elevated and papulous borders and a granular base covered by purulent secretion in which were found forms of the paracoccidioides. The rectal mucosa was hyperemic and bled easily. There were two small ulcerations in the middle portion of the rectum. The lungs were not involved. In the second case the only lesion was a small superficial ulcer of the rectum, with irregular contour and covered by purulent secretion. Biopsy revealed the presence of paracoccidioides. There was no pulmonary or other involvement. Both patients were treated successfully with sulfadiazine.

The anorectal localization of the disorder must occur more frequently than is generally believed. Only 2 cases have been described in the literature. The intestinal lesions are usually located in the cecoappendicular region, are of variable size with a granular base, and may involve the serosa, with consequent inflammatory reactions and the formation of adhesions. The agent usually causes a granulomatous reaction of diffuse type that starts in the lymphatic follicles and Peyer's patches of the submucosa. A careful proctologic examination should be made in every case of South American blastomycosis because of possible rectal involvement.

Paracoccidioides brasiliensis is found on plants and in the soil. The frequent habit of the Brazilian "mestizo" to cleanse his anal region with vegetal leaves should lead to an increase of the anorectal forms of the blastomycosis. However, there may be other etiopathogenic mechanisms for such lesions. They could occur through direct localization of the previously swallowed parasite, or the parasite could reach the perirectal lymphatics through lymphatic dissemination of the process from some other part of the body. Other conditions may favor the localization of the agent in the rectal mucosa, as amebiasis and lesions caused by shigellas. The diagnosis is not difficult. The parasite is easily found. It has a characteristic morphology, especially in fresh specimens. In case of ulcer, biopsy is advisable.

Sulfadiazine is the treatment of choice. A blood concentration of 5 to 10 mgm. per 100 cubic centimeters is sufficient to guarantee frank amelioration. The sulfonamide may be applied locally in the form of pulverization or nebulization. Polyvalent antimycotic vaccine therapy is recommended in addition to general medication to increase the organic resistance of the patient. Unfortunately there is as yet no proof of the cure of the disorder; therefore a periodic follow-up is necessary for timely attention to possible recurrences. RICHARD KEMEL, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Cancer of the Gall Bladder (Cancer de la vesicula biliar) ARNALDO YODICE Y EMILIO ETALA. *Dia méd.*, B. Air., 1948, 20: 1366.

This article is an analysis of 14 cases of cancer of the gall bladder; all except 2 of the patients had an

associated cholelithiasis, and in 11 it was of the scirrhous type. The following symptoms predominated: (1) pain in 62 per cent, (2) icterus in 69 per cent, and (3) palpable tumor in 68 per cent.

Eight of the 14 patients showed calcification of the gall bladder on preoperative roentgen films, and laparotomy was not only necessary to confirm the diagnosis of cancer but was of value for prognosis and metastatic studies.

Nine patients were considered inoperable. Three were treated with x-rays and one of these survived 4 years; the 2 others, however, lived only 7 and 8 months, respectively. Of the 5 patients operated upon, one lived 2 years, and the others lived 1.5 years, 9 months, 5 months, and 3 months, respectively.

Because of the desolate outcome of the 14 cases described it is hoped that the observations given may help to alert others toward an earlier recognition of cancer of the gall bladder.

STEPHEN A. ZIEMAN, M.D.

Considerations with Regard to a Case of Acinous Carcinoma of the Pancreas with Hypoglycemic Manifestations (Consideraciones acerca de un caso de carcinoma acinoso de pancreas con manifestaciones hipoglucémicas anteriores). GUNTHER A. FROMM and EDUARDO F. LASCANO. *Arch. argent. enferm. ap. digest.*, 1947, 22. 425.

Despite the difficulty of proof, the authors attempt to show the causal relationship between carcinoma of the head of the pancreas and an associated hypoglycemia with the functional modifications of the central and vegetative nervous system, the liver, the hypophysis, and the suprarenal and thyroid glands. It is contended that when such manifestations exist along with a presumed pancreatic affection, resort to surgery is indicated, with investigation of each element of the Whipple triad or of Wilder's postulates.

A case is reported of a 31 year old patient who, 7 years previously, had had icterus and associated choledochal blockage. On present admission, the patient was disoriented and confused, later collapsed into unconsciousness, developed convulsive seizures, and was referred for neurologic studies. These proved unrevealing, but because gall-bladder disease was found on physical examination, a laparotomy was performed which revealed a palpable tumor of the pancreas. The tumor, which proved to be an acinous carcinoma, was removed without incident. The associated extraneous symptoms diminished progressively after removal of the tumor.

It was concluded that the carcinoma created the hypoglycemia, which, in turn, was responsible for the convulsions, facial paresis, and the other neurovegetative symptoms. The deranged glycogenic metabolism accounted for the suprarenal insufficiency as well as the hypophyseal and thyroid complications. STEPHEN A. ZIEMAN, M.D.

MISCELLANEOUS

The Infected Ovarian Teratoma as a Diagnostic Problem (Ueber die infizierten Eierstockteratome als diagnostisches Problem). KEIJO SOIVA. *Ann. chir. gyn. fenn.*, 1948, 37: 80.

The author stresses the fact that infections in dermoid cysts of the ovary are quite rare. In Blackwell and Dockerty's series, infection was present in only 1 of 273 cases while in other series infection occurred in as high as 11 per cent. The author presents 4 personal cases. Three of these lesions were infected dermoid cysts and the fourth was an infected embryonal teratoma. The source of the infection in 2 of the cases was ascertainable: in one case infection followed vaginal aspiration of the cyst and in the second case infection followed typhoid fever. In the embryonal teratoma, the infection might have been ascribed to a puerperal sepsis.

In a review of the literature, the author found that in most of the early cases of infected teratoma the infection was introduced by diagnostic or therapeutic aspiration. As this procedure has been discarded, the number of infected cysts is also decreasing. A good many cases have been reported in which typhoid or paratyphoid bacteria have been recovered from the cysts. The author's case was such a one. Puerperal sepsis has also been repeatedly reported as a cause of the infection.

The diagnosis of infected cysts is not simple. Its clinical manifestations are almost indistinguishable from salpingitis, tubo-ovarian abscess, and suppurative parametritis. The author believes, however, that in many instances the x-ray examination will be helpful. In almost 50 per cent of cases, teeth or bone can be visualized in the skiagram. These must be differentiated from intestinal content, calcified lymph glands, calculi in the urinary tract, and calcified uterine fibroids. They are less frequently observed in older patients, which leads to the suggestion that the calcium may be reabsorbed. Furthermore, the content of the typical dermoid cyst may cast a negative shadow. The only other intra-abdominal materials casting a negative shadow are gas in the bowel, cholesterin, gall stones, and retroperitoneal lipomas.

Some of the authors have called attention to the possibility of seeing lines which suggest the appearance of hair in the cyst. The author has, however, never observed this. In one case a salpingogram was made while a probe was placed in the vaginal sinus. This film gave a definite clue to the diagnosis.

The only clinical sign which may help in the diagnosis is that a palpable mass may be present which is independent of the uterus. This, in the presence of the signs of infection, may lead one to suspect the presence of an infected dermoid cyst. The only sure method of diagnosis is the exploratory laparotomy.

WILLIAM C. BECK, M.D.

GYNECOLOGY

UTERUS

Primary Dysplastic Involuting Myofibrosis of the Uterus (Miofibrosi primitiva displastica involutiva dell'utero). PAOLO FORNI. *Riv. ital. gin.*, 1948, 31: 258.

The author reports 2 cases of primary dysplastic involuting myofibrosis of the uterus in nulliparas (one, 27, the other 32 years of age) whose menstruations had been abundant from their inception; both patients had developed menorrhagia which caused severe anemia; the uterus was uniformly enlarged and subtotal hysterectomy and bilateral adnexectomy were performed.

Macroscopically, the uterus, although enlarged, had practically retained its original form and was markedly indurated. On section, the myometrium had lost its normal aspect, but the mucosa seemed to be intact. The increase in volume was due to thickening of the muscular wall and dilatation of the uterine cavity. The myometrium presented an anemic aspect and was of a yellowish color, against which stood out a whitish network of glistening striae having the appearance of tendinous fibers that grated on cutting. Microscopically, there was a more or less marked hyperplasia of the muscular elements (in the first case) and of the fibrocytic elements (in the second case). Their increase seemed to run parallel, the proportions of the two remaining the same all over the uterus. The vascular changes were only secondary and without peculiarities. There were no inflammatory processes, or remnants of such processes, and no infiltrates.

From the histologic and histochemical characteristics of the proliferated tissue, there was no question of cicatricial tissue, but of a particular type of tissue which assumed simultaneously the aspect of muscle and of connective tissue and seemed to derive from a genotypically vitiated bud. In other words, there seemed to be a missed or deviated maturation and differentiation of the primary mesodermal elements which should have produced the muscular elements of the uterine wall and, therefore, also a rapid degeneration of the newly formed muscular elements with formation of a myomesenchymal tissue which, being more resistant, had determined the increase in volume and later the fibrosis of the uterus. The varying degrees of hyperplasia and of evolution of these elements could thus explain the varying aspects (myohyperplasia, sclerosis, etc.) which these so-called fibrotic or sclerotic uteri present histologically, and also the absence of any signs of previous or actual inflammatory process. Consequently, there is here an involuting dystrophic dysplasia of the muscular cells of the myometrium, the picture of which can be found in other lesions of the striated muscles, as, for instance, in cases of congenital torticollis.

The various pathogenic factors advanced by some (particularly pregnancy, the menopause, and menstruation, because of the circulatory disturbances which they produce in the myometrium) would thus simply play the role of adjuvant etiologic factors in the determination of the fibrous involution of the uterus. For these reasons the author calls the lesion a primary, dysplastic, involuting myofibrosis, representing a well defined entity which may have some aspects in common with fibromyomatosis and, to a lesser degree, with fibroma rather than with fibrosis or sclerosis, which terms should be reserved for results of metritic processes. RICHARD KEMEL, M.D.

Technique of Radium Therapy for Cancer of the Uterine Cervix (Sur la technique de la curiethérapie des cancers du col de l'uterus). ÉMILE WALLON. *Presse méd.*, 1948, No. 19: 244.

Successful results of radium therapy in cancer of the uterine cervix are largely dependent upon a most precise technique. Lacking this, apparently satisfactory immediate results may be followed by recurrence or serious complications. Failures may be attributable to inadequate dosage, exclusively vaginal application, inadequate protection of adjacent tissues and organs, or to a secondary radioresistance developing as a result of insufficient treatment. Failures have, however, been reported in cases in which no obvious fault in technique could be demonstrated. In such cases, the distribution of radiation may have been interfered with because of difficulty in adjusting the apparatus at onset, or its subsequent displacement. Because of scattering of the rays, the dose received by the tissues may vary widely and some tissues may escape irradiation altogether.

A series of roentgenograms are presented to illustrate the cause of some failures. Thus in some patients with retroversion of the uterus there may be marked infiltration and retraction of the vagina, forcing the end of the tube toward the rectum. Since only a single tube can be inserted, the radiation affects too limited an area to produce complete sterilization, and unless it is supplemented by radiotherapy, parametrial recurrence may be expected.

Destruction of tissue may also lead to displacement of the radium containers with resulting irregular distribution of the rays. In some cases there is a tendency of the tube to slip out of the uterus, and unless a control roentgenogram is taken, the operator, believing the apparatus to be in the correct position, might have delivered the usual dose with resulting rectal complications. The tube may also be displaced by the colpostat which leads to overdosage or inadequate dosage, according to its location. Overdosage to one of the lateral cul-de-sacs owing to displacement of the apparatus may cause injury to the ureter. Without routine roentgenologic control, it is difficult to know whether the radium treatment has

been satisfactory. Errors detected by this method can be rectified as a rule, but in some cases errors defy detection, as, for instance, in cases of neoplastic fixation of organs in abnormal positions. However roentgenologic examination is useful also in these cases since by indicating areas insufficiently treated, the latter can be reached by roentgen therapy.

Radiologic control will permit a more precise study of the exact cause of failure in certain fatal cases. Before concluding that a tumor is radioresistant, it is necessary to ascertain that the radium is properly placed. EDITH SCHANCHE MOORE.

Reticuloplasmocytosarcoma of the Uterine Cervix (Sul reticoloplasmocitosarcoma del collo uterino). FRANCESCO SESSA. *Quad. clin. ostet. gin.*, 1948, 3: 191.

A 49 year old woman had been suffering for a year with a fetid leucorrhea, and of late had had severe pains in the lower abdomen. At the Cancer Institute of the Vittorio Emanuele Hospital, in Catania, Italy, the cervix was observed to be markedly swollen and indurated, and covered with reddish-gray easily bleeding vegetations. The Wassermann reaction was negative, even following reactivation.

A biopsy was done and the histological examination of the specimen disclosed a mass made up of reticular tissue with a predominance of plasma cells, with a pronounced pyroninophilia (Pappenheim) of their protoplasm. Some of these cells were smaller and resembled histiocytes; however, these also were pyroninophilic and were classed as immature plasma cells or preplasmocytes. Some of the cellular elements of the reticular component were also quite large with, at times, two or more nuclei. All these elements showed a tendency to group themselves about the numerous blood vessels which, however, showed no indication of syphilitic changes. Many cells of all types exhibited mitotic figures.

It is believed that the tumor in this case was of a sarcomatous, malignant character, arising from the reticular tissues and exhibiting a tendency to develop by metaplasia into plasma cells. It is also thought to be the first tumor of its type, in this location, which has thus far been reported in the medical literature. The findings in this case confirm the author's belief that the plasmocytoma is often confused with chronic vegetative masses about the feminine genitalia which are of syphilitic or gonorrheal origin, and that the true plasmocytoma is in itself very rare in this location. JOHN W. BRENNAN, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Microscopic Studies on Chocolate Cysts. A Contribution to the Etiology of Intraperitoneal Endometriosis (Mikroskopische Studien an Schokoladenzysten. Ein Beitrag zur Aetiologie der intraperitonealen Endometriose). VOEGE. *Geburtsh. und Frauenh.*, 1947, 7: 48, 87.

The etiology of chocolate cysts has been a controversial subject in the literature for many years. Most authors adhere to the implantation theory. The fact that these cysts occur most frequently in the ovary supports this theory; small particles of endometrium tissue are carried back with the menstrual blood to the ovary when, for some reason or other, the outflow through the cervix is impeded.

However, many authors have been unable to find endometrial tissue in histologic examinations of chocolate cysts. Experienced gynecologists like Philipp and Huber believe that in only 60 per cent of cases are these cysts caused by endometriosis, and that in many cases they occur as the result of a primary hemorrhagic diathesis in the capillaries.

The author examined a series of 50 chocolate cysts histologically and was able to find endometrial tissue in every one of them. He believes, therefore, that implantation of displaced endometrium is the sole cause of chocolate cysts. He discusses the technical difficulties in finding the endometrial tissue, especially in large cysts, and believes that the wall of the cyst should be examined in fresh condition, immediately after the extirpation. The cysts are never entirely surrounded by a membrane, and usually there is a defect at the posterior wall. It is in this area that endometrial tissue is most likely to be found.

The reaction of the endometrial tissue in the cysts to the ovarian hormones varies in the individual cases. If the tissue is walled off by ovarian stroma, muscle fibers, or connective tissue, it is not influenced by the hormonal cycle but remains in the proliferative stage. If, on the other hand, the endometrium grows toward the cavity of the cyst, it shows the same cyclic changes as the endometrium of the uterus.

With regard to the etiology of external endometriosis, the theory of Philipp and Huber is that all cases of chocolate cysts are due to endometriosis in the fallopian tubes. The author examined 27 patients with chocolate cysts in the free abdominal cavity, at a loop of the ileum, or at the appendix. In only 4 of these was he able to find endometrium in the tubes although the entire length of both tubes was carefully examined by serial cuts. He believes, therefore, that in most cases, external endometriosis also is caused by uterine tissue which has been washed back with the menstrual flow.

WERNER M. SOLMITZ, M.D.

Thecoma of the Ovary and Carcinoma of the Endometrium (Tecoma del ovario y carcinoma del endometrio). JUAN CARLOS AHUMADA, RODOLFO SAMMARTINO, and JUAN L. SARDI. *Obst. gin. lat.-amer.*, 1948, 6: 34.

Three cases of thecoma of the ovary associated with carcinoid proliferation of the endometrium are presented. The query proposed is whether there is a direct causal relationship between the two conditions or they are coincident and coexistent findings. No positive position is taken; however, certain inferential conclusions are given, such as the relative frequency of thecoma of the ovary and atypical

hyperplasia of the endometrium, and the effects of thecoma of the ovary on the postmenopausal uterus.

In many instances the small size of a thecoma of the ovary may cause it to be overlooked during a gynecologic examination.

STEPHEN A. ZIEMAN, M.D.

EXTERNAL GENITALIA

Vaginal Autodepuration. Present Status of the Problem and Its Possible Development: The Biologic Significance of Lysozyme in the Vaginal Secretions (L'autodepurazione vaginale. Stato attuale del problema e suoi possibili sviluppi: significato biologico del lisozima nell'umore vaginale). G. VECCHIETTI. *Quad. clin. ostet. gin.*, 1948, 3: 73.

In the study of Fleming's lysozyme, an attempt is made to develop a reliable method of estimating quantitatively the amount of lysozyme present in the various body secretions, excretions, and fluids available to a gynecologist. The method used at present is a modification of that of Sherwood, Falco, and DeBeer for the estimation of penicillin dosages. The use of inverted cylinders over a culture in agar, as developed by the Oxford workers with penicillin, is rejected as too full of inaccuracies for quantitative work. At present the method used is based on the cutting of small holes in the surface of the agar plate and the insertion of the material to be tested in these small wells. The organism employed for these agar plate cultures has been the Micrococcus lysodeikticus which is extremely sensitive to the lytic agent.

With use of the author's method, it has been determined that many of the body fluids and substances contain these lytic enzymes—enzymes in that they are not used up in the process of carrying out the lysis. They are present in greatest concentration in the human being and to a lesser degree in animals. Even certain plant constituents contain them. Most interesting is their presence in great quantities in the albumin of the egg. In the realm of gynecology and obstetrics they are found in the amniotic fluid, in the funicular blood, and in the vaginal secretions. It is this latter finding which the author tries to fit into the vast and complicated picture of vaginal depuration.

The lysozyme was found in all the secretions of the vagina. It was present in very high concentration in the protective cervical mucous plug and the amount became less in the lower regions of the vaginal tract, but even at the outlet it still showed considerable activity. In the vagina of the newborn infant, Fleming's lysozyme is already present in small amounts which increase notably by the fifth to the seventh postnatal day until, in the adult, the amount normally reaches the level of 1,600 to 51,200 U.g. (units of lysozyme per gram of material). In the present study, it was not affected by the state of the vaginal *p*H nor by the presence of other bacterial strains in the vagina. The titer always seemed to increase in the presence of inflammatory conditions in the cervix or vagina. During menstruation the values usually dropped to 25, up to 75, U.g., except in one instance of exocervicitis in which the titer remained at 1,600 U.g. Following the menopause also the titer dropped, but remained at a moderate level. During pregnancy the titer was high and remained at the usual level during the puerperium. In the dysfunctional menometrorrhagias the levels were low, and in tumors of the portio and corpus uteri the amounts varied, but they were always higher in the presence of inflammatory complications.

The characteristics of the lysozyme could be easily distinguished from those of the bacteriophages and from the lytic principles of Gengou, of Turro, and of Petterson. The presence of penicillium notatum, the lytic action of associated bacteria on the Micrococcus lysodeicticus, and any antilysozymic activity as the explanation of lysozyme resistance in some of the associated organisms could be excluded.

From the author's own experiences and from his study of the literature, he concludes that the lysozyme present in the vaginal secretions acts as a valid defense against the microbic increments in the lower levels of the genital tract of the normal, healthy human female. JOHN W. BRENNAN, M.D.

Vaginitis Emphysematosa. HERMAN L. GARDNER. *Am. J. Obst.*, 1948, 56: 123.

Of such rarity is the condition variously known as vaginitis emphysematosa, colpohyperplasia cystica, and emphysematous colpitis that it might well be placed within the realm of medical curiosities. The author presents a case report of vaginitis emphysematosa, giving full microscopic and gross details of the condition.

The characteristic lesion is one of gas-filled cystoid cavities of the mucosa and submucosa of the vagina and cervix. The lesion usually involves both the upper vagina and the cervix, but occasionally is limited to one site or the other. Vaginitis emphysematosa is more often seen during pregnancy. The condition is productive of only mild (if any) symptoms. The point of greatest interest concerns its etiology and this remains obscure. Although several theories have been formulated as to its development, none seem acceptable to our present-day pathologists with their increased knowledge of causes and the pathogenesis of diseases. Some possible stages in the pathogenesis of vaginitis emphysematosa are suggested. Argument is presented to support the opinion that the gas within the lesions has an endogenous origin as opposed to an assumption that the gas is air. JOHN R. WOLFF, M.D.

Abdominal Colpocystopexy for Complete Prolapse of the Vagina and Bladder. PAUL F. FLETCHER. *Am. J. Obst.*, 1948, 56: 41.

The author submits the "rectus suspension principle of crossed-suspender support" as a dependable surgical procedure in the treatment of complete prolapse of the vagina and bladder following hysterectomy for patients in whom an abdominal operation is not contraindicated. The important factor in-

volved in complete prolapse of the vagina pertains to the complete eversion of the anterior vaginal wall and bladder. It is the correction of this condition with which the author is primarily concerned.

The technique and operative procedure are described in detail, and illustrated. The preparation and mobilization of the vagina and bladder are shown. The author utilizes the Moschcowitz technique of closure of the cul-de-sac for the prevention or correction of a hernia of the posterior vaginal wall.

Mobilization and placement of fascial strips from the anterior rectus sheath are performed so that the strip is long enough to reach the ureterovesical junction on the opposite side when the bladder is distended.

The location of the point at which the strips cross each other is decidedly important, because this is the point at which the greatest amount of support to the bladder is rendered. It should be situated on the interior aspect of the bladder wall as close to the posterior border of the trigone as it is conveniently possible to get it. This is facilitated by taking the strips from the anterior sheaths of the fascia rather than from the medial borders. Although it causes the "crossed-suspender" effect to be rendered at a slightly wider angle, the point of greatest support to the bladder is more efficiently located.

Postoperative treatment is routine except that continuous bladder drainage is maintained for at least 6 days. When drainage is discontinued, careful precautions must be taken to be sure that subsequent overdistention does not occur.

The operation was performed for the first time more than 7 years ago. A summary is given of a series of 7 cases in which this principle has been used for the treatment of complete prolapse of the vagina and bladder following hysterectomy.

JOHN R. WOLFF, M.D.

MISCELLANEOUS

The Restorative Operation Following Sterilization (Die Wiederherstellungsoperation nach Sterilisation). H. SCHMIDT-ELMENDORFF. *Geburtsh. & Frauenh.*, 1948, 8: 301.

The authors group sterilization operations into three types: (1) the excision of varying portions of the fallopian tube; (2) burying the end of the tube in the abdominal cavity by enclosing it in a fold of peritoneum; and (3) removal of the entire tube. About half of their patients were sterilized by the burying of the tubal end in the abdominal cavity.

The authors have devised an operation to restore functional continuity of the tube and uterus which is essentially as follows:

The abdominal (proximal) end of the tube is freed and any stenotic portion is removed. Three 0.5 cm. long, equidistant, splitting incisions are made through the entire thickness of the tubal walls and a ureteral cannula is threaded through the lumen of the tube. Through an incision in the posterior wall of the uterus the cannula is introduced to lead the split end of the tube up to the uterine cavity. The split ends are folded back on themselves and tacked to the serosa of the uterine incision. The catheter is led through the uterine cavity and vagina and fixed exteriorly during the postoperative period. This technique tends to reduce cicatricial contracture and stenosis of the tube.

In order that this operation may be done the tube itself must be intact, there must be an adequate blood supply to the tube, and operative compression must be avoided. The best results are obtained in patients who have not had previous infection of the pelvis.

Four of the 9 patients have later become pregnant.

In 10 of the patients in whom the tube has been removed or cannot be reconstructed, the authors have made an ovarian implantation into the wall of the uterus. The results of this type of operation are not remarkable. Even if functional ovulation is restored, as evidenced by regular menses, rarely do fecundation and pregnancy ensue. This may possibly be due to the fact that the ovum does not have a protected course en route to the nidation site, or it may be possible that the uterus changes postoperatively so that it becomes unsuitable for nidation. In the literature, only 12 of 240 patients with an ovarian transplant into the uterine fundus have had successful results, and of these, 4, or less than 1 per cent of the total, have given birth to living children.

JANE C. MACMILLAN, M.D.

Fundamental Operative Methods of Repair of Urinary Fistulas in Women (Metodi operatori fondamentali di riparazione delle fistole urinarie nella donna). CARLO COLOMBINO. *Urologia*, 1948, 15: 99.

The vaginal route of repair of urinary fistulas may be employed in the majority of cases, while the employment of the combined extraperitoneal suprapubic and vaginal approach is recommended chiefly in presence of adhesions to the anterior pelvic arch. The transvesical route belongs to the domain of the urologist. In difficult cases, especially in patients who have previously undergone surgical interventions, a two stage operation is recommended by the author, the first stage consisting of suprapubic cystostomy for derivation of the urine.

The author favors Schuchardt's incision because it facilitates access to the lesion.

In the postoperative treatment the importance of the retention catheter is stressed, in addition to the use of sedatives for the purpose of immobilization of the patient during the first few postoperative days. Prophylactic use of urinary antiseptics and daily irrigations of the bladder with mild mercurial solutions are recommended by the author. Periodic examination of the operative regions are made starting on the third or fourth postoperative day. As a rule, the retention catheter is removed on the twelfth day.

In a case with complete destruction of the urethra, an interposition of the uterus furnished good results.

JOSEPH K. NARAT, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Serum Beta-Glucuronidase Levels during the Toxemia of Pregnancy. LESTER D. ODELL and DONALD F. MCDONALD. *Am. J. Obst.*, 1948, 56: 74.

The purposes of this report are (1) to re-emphasize the differentiation by serum beta-glucuronidase values of pre-eclampsia and hypertensive toxemia of pregnancy; (2) to illustrate the use of beta-glucuronidase levels in detecting a potential pre-eclampsia; (3) to point out that beta-glucuronidase values are apparently of no prognostic value; (4) to report levels for convulsive toxemia of pregnancy; (5) to illustrate examples of toxemia of pregnancy in which repeated serum levels of enzyme were obtained, and to correlate these with the clinical course of the disease.

Although the upper range for normal pregnancy does not exceed 17.5 micrograms per cubic centimeter at term, with few exceptions serum beta-glucuronidase values were high during pre-eclampsia. In fact, a figure above 20 micrograms seemed diagnostic for this condition. In patients with hypertensive toxemia most levels were within the range for normal pregnancy. Several patients were observed as long as 5 months without an elevation of serum beta-glucuronidase.

The authors summarize 5 cases in which the patients had convulsions. The serum beta-glucuronidase levels were not elevated during all the cases of convulsive toxemia of pregnancy.

Forty-five patients exhibiting an abnormal weight gain were selected at random after 28 weeks of pregnancy and from one to four serum beta-glucuronidase levels obtained at intervals of every 1, 2, or 3 weeks. Consistently higher values were found in patients developing pre-eclampsia.

From the results of this study it would seem that serum beta-glucuronidase levels could be used to differentiate pre-eclampsia from hypertensive toxemia, but of possible greater importance would be its use to delineate those patients with excessive weight gain who are destined to develop pre-eclampsia from those who are not. Serum beta-glucuronidase determinations, obtained at 3 week intervals, after 28 weeks' gestation, might warn the obstetrician previous to such an eventuality.

JOHN R. WOLFF, M.D.

The Effectiveness of Various Diuretic Agents in Causing Sodium Excretion in Pregnant Women. WILLIS E. BROWN and J. T. BRADBURY. *Am. J. Obst.*, 1948, 56: 1.

The concept that edema may be due to a disorder of sodium metabolism has gained popularity to the extent that the clinical management of toxemias of pregnancy now generally includes a reduction in sodium intake. Because of the interest in sodium and in the factors involved in augmenting its excretion, a series of studies was undertaken to investigate the effects of so-called diuretic agents on the fluid and sodium excretion in women with normal and toxemic pregnancies.

The authors found that diuretic agents vary in their ability to increase the excretion of water or sodium, or both. Some preparations which are popular as diuretics, such as urea and hypertonic dextrose, were shown to be ineffective in that they did not increase the output of urine.

There seems to be a slight increase in volume of urine and in sodium excretion, induced by adequate amounts of ammonium chloride. The continued administration of ammonium chloride over the second and third days, after an increased sodium excretion has been obtained, is relatively ineffective.

Mercurial and xanthine diuretics cause a moderate increase in urinary volume and the most marked increase in total urinary sodium of any of the agents studied. This effect can be obtained with either the mercurials or aminophylline but, from the pharmacological point of view, there seems to be little advantage in combining the two, as in the commercial compounds.

Three patients with moderately severe toxemia were studied with regard to both sodium and urinary excretion. While these studies are too few to be of any clinical value, it is of interest that apparently the toxemic patient handles water and sodium in a manner similar to the normal pregnant woman, and responds in a similar fashion to diuretic agents. The evidence available suggests that the mercurials and xanthines are worthy of clinical trial in the management of the toxemic patient.

The clinical management of toxemic patients generally includes a liberal use of sedatives, such as morphine. If observations of the antidiuretic effect of morphine are confirmed, its use in patients with oliguria may need to be restricted.

JOHN R. WOLFF, M.D.

Acute Leukemia and Pregnancy (Leucemia aguda y embarazo). JULIO BAZÁN, FRANCISCO A. URANGA IMAZ, y JORGE ALBERTO FERNÁNDEZ. *Obst. gin. lat.-amer.*, 1948, 6: 145.

In reporting a case of acute leucemia and pregnancy, the authors observed that this was the first instance of this disorder at the Maternity Institute, Buenos Aires, in 120,000 admissions. Furthermore, they were able to collect only 88 such cases in the world literature.

Their patient was a 24 year old Italian woman, a para-iv, who was in the fifth month of pregnancy when she suddenly became prostrate and complained of headache, chills, fever, vomiting, enterrorhagia, and showed ulcerous necrotic lesions in the mouth. Clinical and laboratory studies established the diagnosis. The course of the disease was rapidly downgrade

despite interruption of the pregnancy, the patient dying 2.5 months later.

The authors bring out the necessity of differentiating between acute leucosis and leucemia, the latter being malignant and irreversible. When associated with pregnancy it has 100 per cent maternal and 60 per cent fetal mortality. Interruption of the pregnancy apparently has little influence upon the course of the disease. STEPHEN A. ZIEMAN, M.D.

Pregnancy and Fibroma (Grossesse et fibromes). G. GEERAERT and R. VOKAER. *Bruxelles méd.*, 1948, 28: 765.

Opinions as to the significance of fibroma in pregnancy vary widely; some authors consider their presence a catastrophe and others believe that pregnancy is not seriously affected except in rare instances. Also, statistics relating to the incidence of fibroma in pregnancy vary widely—from 1 case of fibroma in 1,000 pregnancies to 50 per cent of cases. The authors believe the incidence to be around 1 in 100 cases.

Following a brief discussion of the pathological anatomy of fibroma, the authors proceed to consider the effect of pregnancy on fibromas. It is estimated that during pregnancy about 18 per cent of fibromas undergo red degeneration, an aseptic process with local hemolysis. Changes in size of the fibroma have been noted (usually hypertrophy, which occurs chiefly in the interstitial fibromas during the first months of pregnancy). Attention has been drawn to a not infrequent regression of the tumor during pregnancy. Also, displacements of the tumor may occur, the anterior myoma ascending more frequently than the posterior. Torsion of the pedicle of the fibroma is less common and usually it is associated with axial torsion of the uterus. It is the sessile rather than the pedicled tumors that undergo torsion, and usually before the fifth month. Finally, a fibroma of some weight may cause a retroversion of the uterus which may lead to incarceration of the pregnant uterus.

As regards sterility, it appears that the interstitial and, in particular, the submucosal fibromas are chiefly responsible. As to relative sterility, it must be stated that mechanical obstruction leading to abnormal implantations of the ovum renders expulsion of the fetus twice as frequent as in normal implantations, because of death of the poorly implanted ovum, compression by the tumor, incarceration of the uterus, or submucosal hemorrhage.

The literature on the subject of fibroma as a cause of sterility is reviewed. A case is reported in detail in which, in spite of most unfavorable conditions imposed by the tumor, conception took place with normal pregnancy and delivery, at 8 months, of a macerated hydrocephalus. Fibroma is very rarely the cause of ectopic pregnancy. It is especially low tumors that lead to abnormal placentation or malpresentation.

Labor especially is likely to be unfavorably affected by the presence of a fibroma. Multiple tumors may interfere with uterine contractions or even lead to uterine inertia. Most authorities agree that the site of the tumor is the determining factor in the obstruction of labor, although Stoeckel insists that its size is the important factor. Low fibroma, such as fibroma of the cervix or prolapsed subserosal fibroma, may render delivery impossible.

A case is reported of rupture of the uterus with expulsion of the fetus into the abdominal cavity in a case of fibroma of the inferior segment on the right lateral surface of the uterus. The woman recovered following a subtotal hysterectomy. Rupture of the uterus always results in death of the fetus and nearly always of the mother as well. Severe hemorrhage is the rule except in cases in which the vessels are thrombosed. The rupture may be asymptomatic, as in the case mentioned. During delivery, the fibroma may be the cause of severe hemorrhage or it may interfere with normal detachment of the placenta.

During the puerperium one may encounter, besides the usually rapid atrophy of the tumor, a large percentage of uterine infections, aseptic degenerations, or abundant hemorrhage. These secondary hemorrhages are rare.

At present most authorities agree that unless signs of complications develop it is preferable not to intervene surgically for fibroma during pregnancy. Bonafos and Rouxel (1941) even reported a case of nonintervention with favorable results in which the fibroma had become gangrenous during the course of pregnancy. However, surgical indications must be based on the parity and age of the patient, as well as the size and number of the tumors. Some authors recommend routine myomectomy; others perform this operation whenever it is feasible. They contend that hemorrhage can be avoided by careful technique and that the state of pregnancy facilitates enucleation of the tumor. Delivery is nearly always normal in these myomectomized women, and interruption of pregnancy is required in only 10 to 20 per cent of cases. The maternal mortality rate is only 2 per cent. Others advise against this operation.

At term, in the presence of complications, all agree that surgical intervention is indicated. Some perform a cesarean section followed by hysterectomy.

Since the advent of the sulfonamides and antibiotics, more conservative measures are perhaps justifiable. Some authors perform a myomectomy.

During labor, intervention is not indicated unless the patient is suffering from intra-abdominal hemorrhage or the tumor presents an obstacle to normal presentation. The first operation is always a cesarean section, followed by myomectomy if the fibroma is subperitoneal, or by hysterectomy if the tumor is interstitial, or in case of multiple or voluminous tumors. Some surgeons always perform a hysterectomy, believing that enucleation with the risk of infection and hemorrhage, is too dangerous.

During the puerperium, hysterectomy is indicated for necrotic degeneration of the tumor, and myomectomy for hemorrhage. A case is reported of pregnancy complicated by a low fibroma, in which the pregnancy went to term, and a forceps delivery was

accomplished with excellent immediate results. A month later the patient was admitted to the hospital as an emergency case in a severely anemic condition owing to profuse hemorrhages. An intramural myoma the size of an orange was removed. The operation was followed by complete recovery. In this case, the absence of hemorrhage during pregnancy with the sudden onset of hemorrhage one month after delivery was the point of interest.

EDITH SCHANCHE MOORE.

LABOR AND ITS COMPLICATIONS

Methods of Management and Results in Primary Uterine Inertia (Ueber die Behandlungsmoeglichkeiten und Ergebnisse der primœren Wehenschwaeche: Inertia Uteri). VILJO TURTOLA. *Ann. chir. gynaec. fenn.*, 1948, 37: 137.

The author relates his findings and conclusions in 769 cases of primary uterine inertia occurring during the period from 1935 to 1946 in the Second Women's Clinic at Helsinki. Over 60 per cent of the patients were between 20 and 30 years of age. Nearly 80 per cent were primigravidas and of these more than a third were elderly primigravidas, i.e., over 30 years old. Breech presentation occurred in 2.5 per cent of the patients studied. The average duration of labor was 50 hours, 3 minutes, but if calculated from the onset of regular pains it was 38 hours, 5 minutes.

The membranes ruptured spontaneously in 406 cases; in 318 cases artificial rupture was performed; and in 45 instances the records were not complete.

In 270 of the 406 cases in which spontaneous rupture occurred the author analyzed the effect on labor when rupture took place during the first or second stage of labor. In 193 of this group (71.5 per cent), labor improved. In those cases in which the uterine contractions did not increase after rupture of the membranes the average duration of labor was 57 hours and 32 minutes; the average duration of regular pains was 43 hours and 42 minutes; the average time from the onset of labor until rupture was 21 hours and 42 minutes; the average time from rupture until delivery of the child was 35 hours and 50 minutes. The corresponding averages for the cases in which labor was accelerated were: 50 hours and 51 minutes, 38 hours and 30 minutes, 42 hours and 20 minutes, and 12 hours and 31 minutes, respectively. It is thus evident that the salutary effect of spontaneous rupture of the membranes is most apt to be evident when it occurs late in labor.

When the membranes were ruptured by the obstetrician, labor was accelerated in 262 of 318 cases (82.1 per cent). The time intervals in which labor was expedited were: 47 hours and 37 minutes, 36 hours and 20 minutes, 41 hours and 2 minutes, and 6 hours and 35 minutes, respectively. When there was no acceleration the figures were: 54 hours and 50 minutes, 40 hours and 58 minutes, 36 hours and 41 minutes, and 13 hours and 52 minutes, respectively. Hence, it is wise to postpone artificial rupture until late in labor.

Thymophysin was employed in 114 cases, and in 95 cases (83.3 per cent) a favorable effect was noted. Various doses were administered, but an average total dose of 0.75 c.c. was found necessary for good results. There seemed to be little correlation between the time of administration and the shortening of labor. In 34 patients receiving thymophysin operative delivery was later required because of uterine exhaustion.

Pituitrin was effective in all 9 patients in which it was utilized. Quinine aided labor in only 10 (24.3 per cent) of 41 patients in whom it was used.

Operative intervention (excluding episiotomy, artificial rupture of the membranes, and manual extraction of a breech) was obligatory in 234 patients (30.4 per cent)—193 (31.9 per cent) of the 605 primigravidas and 41 (25 per cent) of the 164 multigravidas were delivered by operative means. Forceps deliveries, of which nearly one-half were midforceps, cesarean section, and accouchement forcé, were the most frequent means of operative delivery.

Puerperal morbidity developed in 214 patients (27.8 per cent). The most frequent cause was a mild variety of endometritis. The highest per cent of morbidity in the deliveries accomplished by operative means followed forceps delivery (56 of 112, or 50 per cent).

Two mothers (0.26 per cent) and 33 children (4.3 per cent) did not survive. High forceps were accompanied with an infant mortality of 11.6 per cent.

The general prognosis of uterine inertia is not favorable, especially so far as the infant is concerned.

WARREN R. LANG, M.D.

Cesarean Section in Detroit During 1945; A Comparison with 1925 and 1930. HAROLD C. MACK and R. S. SIDDALL. *Am. J. Obst.*, 1948, 56: 60.

In Detroit, during 1945, among every 37 births there was one cesarean section; in 1925 there was 1 cesarean section in every 217 deliveries, and in 1930, 1 in 167 deliveries. On the other hand, the maternal mortality with cesarean section in the three series was 13 per cent in 1925, 4.4 per cent in 1930, and only 0.8 per cent in 1945. The fetal death rates for the same years were 11 per cent, 12.8 per cent, and 7.8 per cent. By 1945, low cervical section had become the operation most frequently employed since it had proved to have distinct maternal advantage over the classical operation. Cesarean hysterectomy and extraperitoneal section were performed in 40 cases, without mortality.

A rise in hospital confinements during the 20 year period to more than 94 per cent of the deliveries in 1945 was accompanied by a reduction in the general maternal mortality to 1.6 per 1,000 live births.

In view of the markedly increased incidence of cesarean sections on the one hand and the greatly decreased mortality on the other, the author believes it would be well to consider if too many operations of this type are now being done or if too few were done before. There is evidence that, in 1945, many sections were performed on slight indications, to say

the least. Apparently there is widespread disregard of the fact that although the death rate is low, surgically speaking, it represents a high immediate obstetric risk, as well as a definite hazard in future pregnancies. On the other side of the question, it is noteworthy that in 1945 at least 20 of the 58 maternal deaths were believed to have been preventable, a number of them by timely cesarean section. Both sides of the question, then, seem to involve a proper regard for established indications and contraindications. Specifically pointing the way to further improvement is the fact that in at least 4 of the 8 cesarean deaths in 1945, the fatal outcome was due largely to faulty judgment or management.

The fetal mortality rate of 7.8 per cent in the 1945 cesarean sections, though definitely better than in previous years, is still twice the over-all death rate for infants during the first year of life. The fact that 36 per cent of the infants were stillborn again emphasizes the fact that cesarean section does not necessarily offer the best chance for a living child. Hence, there is no justification for undue extension of the use of cesarean section for purely fetal indications.

JOHN R. WOLFF, M.D.

MISCELLANEOUS

A Contribution to the Study of Conglutination of the Uterine Cervix (Contributo allo studio della conglutinazione del collo dell'utero). S. RIBONI. *Fol. gyn.*, Genova, 1948, 43: 63.

The 2 cases of conglutination are here reported not only because of the peculiar circumstance that this rare condition (1 in 5,000 or 6,000 deliveries) occurred twice within a week's time but also because of the striking differences in pathology and in therapeutic indications. Conglutination at the external cervical orifice occurred in a 24 year old primipara who had always menstruated normally, and nothing abnormal was noted during the pregnancy and even at the onset of labor. After the labor had been in action for 30 hours and the cervix was fully effaced, it was noted that the cervical os was still closed and apparently occluded and obstructed by a whitish plug of a substance of greater firmness than the surrounding tissues. A moderate amount of pressure by the examiner's finger was sufficient to force the occlusion, whereupon the uterine orifice immediately spread apart with the appearance of the bag of waters. After a rather slow labor a living female child of 3,500 gm. was extracted with the forceps.

The second patient, a 38 year old gravidaii, had undergone a forceps delivery of a dead child. During the present pregnancy a flat pelvis (conjugata vera 9.2 cm.) was demonstrated but nothing abnormal was detected about the cervix. Here, as in the first delivery, premature rupture of the membranes occurred and a subsequent fetal asphyxia forced immediate cesarean section. The child was eventually resuscitated; however, preservation of the uterus seemed indicated, in this doubtful period to preserve the procreative power of the mother. The lower portion of the amniotic sac about the internal cervical orifice was adherent to the uterine wall and the internal os itself seemed to be conglutinated. The operator's finger inside the uterus could be forced part way through the cervical canal and then a curved forceps was forced the rest of the way through into the vagina and the tract thus formed was dilated. Subsequently upon vaginal examination it was found that the forceps had deviated from the canal and forced a false passage behind the true cervical opening. The lip of the cervix was then grasped by a tenaculum and a straight forceps was forced along the true cervical canal which was thoroughly dilated. This opening was considered adequate for drainage, although there was a huge clot in the uterus resulting from a partially detached placenta. The contents of the uterus was foul. The patient had manifested a fever during the period of delivery. The peritoneal cavity was dusted with sulfonamide, a sulfonamide-gauze drain was left in the uterine cavity, and the administration of penicillin was started. Recovery was uneventful.

The author believes that with the new surgical aids hysterectomy is no longer indicated in these cases of conglutination if adequate drainage can be assured through the cervix.

JOHN W. BRENNAN, M.D.

Peritonization of the Lesser Pelvis with Vesical Peritoneum and Its Obstetrical Consequences (La péritonisation du petit bassin avec le péritoine vésical. Ses conséquences obstétricales). G. COTTE and J. MATHIEU. *Rev. fr. gyn. obst.*, 1948, 43: 12.

In most conservative operations on the adnexa, the vesical peritoneum is left intact and can be used to cover the raw surfaces of the uterus and parametrium. In cases in which only the ovaries and uterus can be preserved, and therefore with no possibility of pregnancy, the uterus may be completely hooded by the flap which is sutured to the peritoneum to cover the uterine isthmus and uterosacral ligaments. If the base of the cul-de-sac of Douglas has likewise been denuded, it too can be covered by excluding it with a suture of the vesical flap to the anterior surface of the rectum. To prevent fresh adhesions to the ovary, it is always left above this level in a peritoneal cavity with normal walls. After experience with this intervention for 25 years, the authors conclude that with this technique they can prevent the majority of failures attributed to conservative operations for adnexitis.

However, in cases of only unilateral castration and of myomectomy, the uterus cannot be brought into so accentuated an anterior position as attempted in the cases mentioned. Generally speaking, it would seem wise not to pass beyond the utero-ovarian ligaments posteriorly. It is even suggested that the end of the vesical flap be sutured on the sides to this ligament, which leaves the tube quite free. However, if raw surfaces remain on the side from which the adnexa have been removed, these may be excluded by suture of the vesical peritoneum farther posteriorly

on this side. Possibly following cicatrization there may be some torsion of the uterus on its axis, which might be responsible for the obstetrical complications recently described as a result of this method by Gonnet. Hitherto no such complications have been reported. During the past 3 or 4 years, however, several cases of dystocia in patients previously subjected to vesical peritonization have been reported. In Gonnet's series of 96 cases of pregnancy following vesical peritonization, 90 per cent of the patients were normal. The incidence of complications during pregnancy was no greater than in nonoperative cases. The incidence of abnormal presentations was, however, 9 per cent as compared with 0.5 per cent in nonoperative cases. These were chiefly shoulder presentations. In such cases, labor does not begin normally, and if it is not induced the fetus may even die in utero. Cesarean section is the only suitable procedure and should be done promptly to save the life of the infant. In operations performed on such patients, it was frequently observed that the uterus was in a position of left or right torsion with the adnexa accordingly forward. The bladder most frequently had moved upward on the anterior surface of the uterus, completely covering the inferior segment, so that hysterotomy was usually preferable to low cesarean section.

The authors have attempted to discover the mechanism responsible for these abnormal presentations. In 10 of the cases reviewed, in which Gonnet attributed obstetrical complications to vesical peritonization, there were associated factors which would have to be considered. Thus, in 2 cases there was a narrow flat pelvis, in 2 other cases, uteroparietal adhesions, and in 1 case there was low insertion of the placenta; any of these conditions might have contributed toward the abnormal presentation. It was also believed of interest, in attempting to evaluate the role of vesical peritonization in these complications, to ascertain the type of the previous gynecologic intervention. It was noted that although abnormal presentation occurred in 2 cases in which the Pestalozza peritonization had been done for correction of retrodisplacement, in 20 other cases in which there had been no myoma or adnexitis the pregnancy and delivery were normal, including a case in which the peritoneal flap had been sutured in back of the uterosacral ligaments (with 2 subsequent normal pregnancies). In only 3 of 30 patients with peritonization following unilateral castration were there subsequent pregnancies with abnormal presentations. The incidence of the latter following myomectomies was slightly higher, probably because of the uterine cicatrization. In patients who became pregnant after peritonization for extrauterine pregnancy and endometriosis of the isthmus, deliveries were normal. Therefore, the incidence of abnormal presentation following the Pestalozza procedure is from 6 to 7 per cent.

The high incidence of shoulder presentations is attributed by the authors to faulty technique, namely, to the fact that during peritonization the bladder has not been adequately liberated from the vesical peritoneum, which permits the bladder to rise, frequently half way up the pregnant uterus, as demonstrated by the adhesion of the bladder to the wall of the uterus. Bertrand and Roman have emphasized the importance of incising the small fibromuscular bundles which moor the bladder to the peritoneum near its apex. With these divided it is possible to push the bladder completely behind the symphysis, and the peritoneal flap thus obtained is very thin and flexible and would in no way interfere with development of the pregnant uterus. Following myomectomy, it is possible that the raw uterine surfaces at the site of the hysterotomy incisions form solid adhesions with an insufficiently displaced bladder.

The authors conclude that in spite of these occasional obstetrical complications, vesical peritonization has too many advantages to be abandoned. It not only permits excellent end results in conservative surgery but a considerable number of pregnancies may be saved in patients operated on for myoma and adnexitis. An important factor in technique is the adequate retrodisplacement of the bladder.

EDITH SCHANCHE MOORE.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

A Case of Anuria Due to Mercury Bichloride Poison Cured by the Intravenous Injection of Novocain (Un cas d'anurie due a l'intoxication par le sublimé, guérie par des injections de novocaïne intraveineuse). KAREL UHLIR. *J. urol. méd*, Par., 1948, 54: 48.

After a brief review of the pathology, the author describes two clinical aspects of mercury bichloride poisoning: (1) the initial polyuria and albuminuria which results after a few hours in anuria (this concerns the mild cases in which diuresis is re-established and followed eventually by polyuria of several weeks' duration); and (2) the severe condition in which anuria occurs without preceding polyuria.

The general management consists of the administration of fluids, gastric lavage, and the administration of an antidote if such exists.

The author had no opportunity to try "BAL," British antilewisite.

In severe cases the medical treatment is without result. The same is true for decapsulation or nephrostomy performed in order to promote kidney function. Also, splanchnic or lumbar sympathetic block with novocain has been without result, although efficient in other cases of anuria. The intravenous injection of novocain recommended by French authors has brought good results in anuria caused by bilateral kidney calculus, sulfanilamide, or chronic nephritis.

The author describes the case of a 47 year old patient who in a suicidal attempt took 12 gm. of mercury bichloride. The routine medical treatment was without result and the patient was anuric with advancing azotemia for 5 days The author injected from 10 to 15 c.c. of 1 per cent novocain solution twice a day intravenously from the fifth to the eighth day, and 15 c.c. of this solution once a day from the ninth to the sixteenth day. The urinary output started 3 hours after the first injection with albuminuria and casts. After 24 hours it was 75 c.c. and it gradually increased within the following 6 days to 1600 c.c. per day, at the end of the twelfth day after onset of the condition. From then on the range of output was between 1,500 and 2,500 c.c. per day. The blood chemistry became normal and at the end of 2 months the urine was free from albumin and normal kidney function was present.

ERNEST BORS, M.D.

A Contribution to the Production of Experimental Nephritic Lesions. Nephrosclerosis Produced by Cellophane (Contributo alla produzione di lesioni nefritiche sperimentali. La nefrosclerosi da cellofan). ROBERTO CACCHI. *Arch. ital. urol.*, 1947, 22: 217.

In 18 dogs experimental nephritic lesions were produced by wrapping their kidneys in cellophane according to Page's method. The transperitoneal approach was used, and first one kidney, and 20 days later the other, was surrounded by cellophane. In this manner perirenal as well as parenchymal lesions were produced. Changes in the interstitial tissues, glomeruli, tubules, and blood vessels were thus provoked. The relatively chronic changes greatly resembled those in human nephrosclerosis. The histologic changes were analogous to those in chronic interstitial nephritis. Angiographic examinations of the vascular network supplemented the histologic studies.

The author concludes from his investigations that the use of cellophane for wrapping the kidneys merits especial attention among the various methods of producing experimental nephritis, because the characteristic complex of such lesions may thus be provoked and because the relative chronicity of the evolution of the process allows the utilization of experimental animals for scientific studies. No other experimental method is capable of producing such intensive parenchymatous as well as perinephritic changes as those created with cellophane. JOSEPH K. NARAT, M.D.

Injury of the Ureter from Gunshot Wounds. CARL F. RUSCHE. *J. Urol.*, Balt., 1948, 60: 63.

Because of inadequate facilities during World War I, injury to the genitourinary tract was accompanied by a high mortality rate since few patients lived to reach a base hospital. However, in World War II, conservative surgery, and early and adequate diversion of both the urinary and fecal streams proved to be the foremost factors leading to good results. Of equal importance was the administration of chemotherapy with the onset of injury, and the rapid transporting of casualties to rear hospitals.

Because of the predominance of penetrating wounds, which are the most likely to occur in war, ureteral injury is frequently overlooked, especially in the stress of emergency work. Furthermore, injuries to important structures intimately related to the ureter are often so severe as to completely mask evidence of ureteral damage, and often death occurs so rapidly that ureteral injury is not discovered.

The pelvic ureter is more frequently injured in gunshot wounds because it is not so well protected as the remaining portion, and is more fixed than the latter which is small, elastic, and often associated with the extensive visceral injuries. Complete division of the ureter is more common than partial severance, and early diagnosis is imperative to conserve renal tissue and obtain the best functional results.

In the greater number of cases, pyelography is the only means of making a diagnosis. Urinary fistula is the characteristic symptom of unrecognized ureteral injury; occasionally it is transitory, the leak arising

from a partial rupture small enough to heal spontaneously and often followed by ureteral stricture.

Extravasation of urine arising from the ureter, even without free drainage, is far less severe than that from the bladder or urethra. When the ureter has been severed and the tissues have obliterated the trace of the bullet, extravasation of urine forms a mass in the adjacent region with sepsis.

The first consideration in treatment is relief of shock. The manner of treating the ureteral injury depends on the location, extent of the injury, and the time at which the lesion is discovered.

In partial rupture of the ureter, extraperitoneal drainage and insertion of an indwelling ureteral catheter, with or without suture, often are adequate. When complete division of the ureter exists, end-to-end anastomosis over a ureteral catheter, with diversion of the urine, is the procedure of choice.

Occasionally, the ureter can be implanted into the bladder when the pelvic ureter is injured. There are very few cases in which ureterointestinal anastomosis is possible. When the condition is recognized early, nephrostomy is the standard method of treatment for a fistula of the abdominal ureter. In late recognition of the presence of a urinary fistula and renal infection, nephrectomy is the method of choice.

JOHN A. LOEF, M.D.

Carcinoma of the Ureter. THOMAS GUALTIERI, JAMES J. HAYES, and ABRAHAM D. SEGAL. *J. Urol.*, Balt., 1948, 59: 1083.

Two cases of primary carcinoma of the ureter are presented, one with early changes and the other, long-standing, with late changes including perforation and a perinephric abscess. In both cases, filling defects in the ureters were noted on pyeloureterograms and an efflux of bloody material was noted when the catheters entered the lower ureters. In the early case, the return through the catheter became clear upon reaching the renal pelvis.

The similarity of the malignant lesions of the conduit system of the urinary tract is noted, and the pathogenesis is discussed.

We believe that future investigation of this problem must concern itself with the effects of the various methods of therapy at hand as also those yet to come; that the goal must be prevention or, failing this, a reversal of the abnormal process with the object of obtaining an absolute cure.

Perhaps the answer may be found in the hormones, enzymes, and their attendant biochemistry, in x-rays and radium, in galvanism and iontophoresis, or even in the domain of the atom, when and if man finds his way around to controlled atom fission therapy.

JOHN A. LOEF, M.D.

Indications and Immediate and Remote Results of Ureterosigmoidostomy (Indicazioni e risultati prossimi e remoti della ureterosigmoidostomia). GIORGIO NICOLICH. *Urologia*, 1948, 15: 131.

The following indications for the operation of ureterosigmoidostomy are cited by the author: inveterate, obstinate tuberculous cystitis, exstrophy of the bladder, carcinoma of the bladder, and cancer of the prostatic gland with intensive cystitis.

The first method by Coffey is preferred by the author to other modifications of the operation.

As to the immediate results, all 5 patients with tuberculous cystitis recovered; one patient with grave cystitis resulting from a cancer of the prostatic gland also recovered; of 2 patients with an exstrophy of the bladder one died and one recovered; and of 14 patients with a cancer of the bladder, 8 recovered and 6 died.

One patient with exstrophy of the bladder succumbed to paralytic ileus. Three patients with cancer of the bladder died from pyelonephritis, one from peritonitis, one from paralytic ileus, and one from pneumonia. The total immediate postoperative mortality in 22 cases was 32 per cent. Of the patients with benign lesions, 14 per cent and, of those with malignant conditions of the bladder or the prostatic gland, 40 per cent died as the result of the operation.

A detailed analysis of the remote results convinced the author that ureterosigmoidostomy represents the method of choice in the treatment of grave forms of tuberculous cystitis. In exstrophy of the bladder compatible with life this procedure or the Maydl operation may be performed. Good palliation may be obtained in malignant lesions.

As to immediate postoperative fatalities, paralytic ileus develops in direct relationship to the duration of the operation, while peritonitis and pyelonephritis are consequences of the necrosis of the isolated ureteral segment.

All patients had perfect continence and were evacuating urine at regular intervals of several hours. The tolerance was better in women than men.

JOSEPH K. NARAT, M.D.

Experimental Contribution to the Implantation of the Ureters into the Rectum according to Bergenhem's Technique (Contributo sperimentale all'impianto degli ureteri nel retto con la tecnica di Bergenhem). VINCENZO LAUDICELLA. *Arch. ital. urol.*, 1947, 22: 248.

Unilateral or bilateral implantation of the ureters into the rectum according to Bergenhem's technique avoids numerous disadvantages accompanying other operative methods. A perfect anatomic union of the implanted ureters with the rectum can be observed after the operation. The resulting ureterointestinal stoma possesses a valvular mechanism which prevents an enteroureteral reflux. The newly created stoma shows no tendency toward the formation of a stenosis. Furthermore, the application of the aforementioned method creates conditions more physiologic than those following other operative procedures.

The following indications are enumerated by the author: exstrophy of the bladder, selected cases of cancer of the bladder, tuberculosis of the bladder with involvement of one kidney, tuberculosis of the prostatic gland and seminal vesicles, incurable vesicovaginal fistula, cases in which great difficulties are

encountered in reimplantation for uterine cancer, and selected cases of painful, contracted, infected, and ulcerated bladder.

The method consists of the formation of a rosette from the vesical mucosa around the severed end of the ureters and implantation of the ureters into buttonholes in the rectum.

The author's conclusions are based on the experiments on 5 dogs. In 3 a unilateral, and in 2 a bilateral, implantation of ureters was performed.

JOSEPH K. NARAT, M.D.

BLADDER, URETHRA, AND PENIS

The Repercussion of Vesical Neck Dysectasia on the Urinary Tract Above the Lesion (Du retentissement des dysectasies cervicales sur les voies urinaries sus-jacentes). JEAN BAUCHART and JEAN GARRIGUES. *J. urol. méd.*, Par., 1948, 54: 16.

The authors studied the effects of dysectasia of the vesical neck on the urinary tract. He divided the cases into three groups. First he considered lesions of the neck: (1) anatomical lesions with sclerosis, and (2) functional contractions due to hypertonicity on a nervous basis. A differentiation between the functional and organic types is frequently impossible, and eventually sclerosis will be present in both.

The second type of cases presented a hypertrophic prostate gland due to adenoma, and the third type of cases presented prostatitis.

Trabeculation and cellulitis were found upon cystoscopy and cystoroentgenography revealed irregular walls, with holes and studded with raised areas. There was residual urine. Of greatest importance however, were the disturbances of kidney function.

Among the many renal function tests, the authors consider intravenous urography as the most conclusive.

When the patient presents a contracted bladder neck dysuria is rarely absent. A residue is usually present when the patient consults his physician. It is constant and progressive. Cystoscopy reveals cellulitis and trabeculation and the residue varies from 100 to 150 c.c. Kidney function is initially good. Sounding and irrigations might relieve the condition temporarily, but eventually resection, which brings cure, is necessary.

The initial stage is short. The residue increases quickly to from 200 and 300 c.c., with consequent bladder infection, the formation of a diverticulum, vesicoureteral reflux, kidney damage, uremia, and pyelonephritis.

An infected residual urine was present in 55 of 65 cases. A bladder diverticulum and a reflux were present in 25 of 65 cases. Approximately 38 per cent of the patients have a reflux, a diverticulum, or both. The diverticulum is considered to be acquired and not congenital. Azotemia was present in approximately 30 per cent and is less frequent in patients with a diverticulum. It is concluded that the diverticulum functions like a safety valve. A parallel between the residue and azotemia could not be established. Intravenous urography has proved to be a superior method, which detects kidney damage earlier than determination of the blood chemistry. In 16 cases the blood chemistry and the intravenous urogram concurred. In 5 cases the superiority of the intravenous urography over determination of the blood urea, Ambard's constant, and phenolsulfonphthalein value could be demonstrated.

The renal infection, pyelonephritis, is thought to be hematogenous. The kidney infection remains inconspicuous, with vague lumbar pain, digestive discomfort, dryness of the tongue, and polyuria. In rare cases, an acute pyelonephritis might develop.

When the patient has an adenoma of the prostate gland, residual urine and dysuria are also present, but their appearance is different. Cases of acute complete retention are frequent as compared with cases of contracted vesical neck. Among 280 patients, 149 revealed acute retention, and 131 no retention. Characteristic of the acute retention in adenoma is its reversibility by simple catherization with complete loss of the residual urine. It is rarely caused by a middle lobe. Eleven of 14 patients with an enlarged middle lobe had no acute retention at any time.

Dysuria is less marked. It was absent in 78 patients, slight or temporary in 165, marked in 34, and unknown in 3. In comparing cases of acute retention with those without retention, dysuria was absent in 59 against 19, was slight or temporary in 86 against 79, was marked in 3 against 31, and was unknown in 1 against 2.

The residual urine in 23 per cent of 90 cases without acute retention ranged from 0 to 100 c.c. In contradistinction in cases with acute retention it ranged from 0 to 100 c.c. in almost 77 per cent. The detrusor muscle is capable of regaining its strength in cases with acute retention once this has been relieved.

Two groups are differentiated: (1) cases with acute retention with slight or absent dysuria and a low residue of urine, and (2) cases without acute retention, with frequent dysuria and a marked degree of residual urine. The explanation is thought to be the invasion of the smooth internal sphincter by the adenoma in the second group. In the first group, the internal sphincter remains undamaged for a long period.

This determines the indication for intervention. In cases with a low residue of urine but persisting dysuria, intervention should be advised; a patient with no dysuria should be regularly supervised in order to intervene in time.

Bladder infection is frequent—less than one-fifth of the cases had a clear urine without infection. Some cases with a high residue remained uninfected. Bladder diverticulum and ureteral reflux are infrequent. Diverticula were observed in 8 of 280 cases of adenoma, whereas they were seen in 21 of 66 cases with contracted vesical neck.

Only 1 case of reflux was seen as compared with 9 in the group with contracted vesical neck. Renal

function is less impaired in cases of adenoma than in cases with contracted vesical neck.

In 33 per cent of the 131 cases without acute retention, blood chemistry revealed damage to kidney function. Among them was the case with reflux and all but 1 case of diverticulum. The diverticulum seems to play the same role as in cases of contracted vesical neck. Kidney damage in cases without acute retention is about the same as in the cases of contracted vesical neck. The cause is again thought to be the involvement of the internal smooth sphincter. A relationship between the blood chemistry and residual urine revealed that the blood chemistry remains normal with a residue below 100 c.c., and that only in one-half of the cases with a residue above 300 c.c. the blood chemistry is elevated.

Among 149 cases with acute retention, 24 per cent revealed damaged renal function upon determination of the blood chemistry. This was almost 10 per cent less than of those in which there was no retention. Only 6 patients had a severely damaged kidney function as demonstrated by blood chemistry determinations (4%). The renal damage was frequently slight and temporary with a rapid return of the blood chemistry to normal. This was demonstrated with the urea, Ambard's constant, and phenolsulfonphthalein tests during acute retention and after the retention had ceased. Renal damage appeared later, was less important, and was frequently reversible. This was contrary to the findings in cases of contracted vesical neck. The lack of invasion of the smooth internal sphincter was the cause of the clinical picture. Repeated acute retention was of no greater consequence for the kidney function than a single instance of acute retention. A comparison of the blood chemistry determination with the intravenous urogram revealed that in cases presenting no acute retention the findings were parallel in 23 cases; the superiority of the intravenous urogram over the blood chemistry determination of blood urea, phenolsulfonphthalein, and Ambard's constant was demonstrated in 5 cases. In cases of acute retention the results of the blood chemistry determinations and of intravenous urography were parallel in 19 cases and in 3 cases the urogram gave better information than the blood chemistry determinations.

The phenolsulfonphthalein test and Ambard's constant test were more sensitive than the blood urea test.

The authors conclude that in a number of cases (the very good and the very poor), the laboratory findings and the intravenous urograms are of equal value. In borderline cases the blood chemistry tests give inadequate information. The Ambard's constant and the phenolsulfonphthalein tests give more information, but the intravenous urogram is superior to all. This is important for the indication for intervention.

In the cases of prostatitis the following forms are distinguished: a sclerosing form and a hypertrophic diverticulous form. Occasionally the latter is superimposed on an adenoma, presenting an adenomitis. Forty cases were studied. Thirty-two cases were examined by cystoscopy and 15 sclerotic and 17 hypertrophic cases were found.

Acute retention might occur during an acute flare-up and was observed in 5 cases (1 sclerotic form, 3 hypertrophic forms, and 1 adenomitis). Diverticula are not rare, being found 6 times among 40 cases. Diverticula are rarer than in cases of contracted vesical neck, but more frequent than in cases of prostatic hypertrophy. No ureteral reflux was seen. Blood chemistry determinations revealed kidney damage in 35 per cent of the cases. The intravenous urogram disclosed kidney damage in cases in which the blood chemistry determinations did not indicate it.

Periprostatitis with ureteral encroachment might rapidly lead to kidney damage. The repercussions caused by prostatitis are in between those caused by the adenoma and the contracted vesical neck.

Cancer of the prostate, especially the scirrhus, develops like a contracted vesical neck. The slow growth might delay the impairment of the renal function. A proliferating epithelioma causes even less dysectasia than a scirrhus.

Cancer of the prostate is not always characterized by cervical dysectasia. It might develop silently without urinary symptoms and become manifested by metastases.

Summary: In a contracted vesical neck, dysuria is the main symptom. It remains constant and the detrusor muscle develops diverticula in its fight against the obstacle.

Adenoma without acute retention, found in somewhat less than 50 per cent of the cases, imitates the picture of a contracted vesical neck. It is less progressive and ends with distention and later kidney damage. In cases of adenoma with acute urinary retention the residual urine remains low and kidney damage is delayed because invasion of the internal sphincter does not occur. Temporary kidney damage during acute retention is reversible. The repercussion from prostatitis occupies a place between that of the two aforementioned conditions.

ERNEST BORS, M.D.

GENITAL ORGANS

Hydronephrosis in Prostatic Obstruction. HERMAN L. KRETSCHMER and FAY H. SQUIRE. *J. Urol.*, Balt., 1948, 60: 1.

The routine use of intravenous urography in prostatic obstruction has become an established procedure on the authors' service at the Presbyterian Hospital, in Chicago. A review of 408 intravenous urograms made during the period from 1933 to 1937, and from 1945 to 1947 was undertaken, and the cases were divided into two groups designated as "A" and "B."

In group A, the average duration of symptoms before medical aid was sought was 60.5 months and in group B, 43 months, a differential of nearly 1½ years. In group A there were 80 cases of hydrone-

phrosis, an incidence of 44.44 per cent; in group B there were 75 cases in which hydronephrotic changes were observed, an incidence of 33.43 per cent.

For purposes of designating the degree of hydronephrosis, the cases were graded on a basis of 1 plus to 3 plus. The evidence indicated little difference in degree of hydronephrosis in the two groups. Of the patients with carcinoma of the prostate, 66.66 per cent of those in group A and 41.66 per cent of those in group B had hydronephrosis.

The authors conclude that hydronephrosis occurs more frequently in patients with malignant obstruction than in those with benign obstruction, and that it is in direct relationship with the duration of the disease in both cases. JOSEPH E. MAURER, M.D.

Primary Carcinoma of the Seminal Vesicle. E. M. GEE. *Brit. J. Urol.*, 1948, 20: 72.

The author records 2 cases of this rarely diagnosed tumor, from the Toronto General Hospital, Toronto, Canada, during a period of 40 years. A review of the literature shows only 21 previously recorded cases of primary carcinoma of the seminal vesicle. The case of Labbe, in 1883, is generally accepted as being the first case described.

In many cases the diagnosis was not made during life. In others the diagnosis was suspected only when the clinical picture was well advanced with retention of urine, hematuria, dysuria, and loss of weight as prominent symptoms. Cystoscopy usually showed signs suggestive of obstruction and secondary tumor invasion. Rectal examination has frequently disclosed a hard nodular or irregular fixed mass above or in the region of the prostate. At autopsy, metastases were widespread, chiefly to the lungs, liver, lymph glands and mesentery.

In Case 1, the patient was a totally asymptomatic 65 year old man who, in 1932, during the course of a routine health examination, was found to have a hardening over the right lobe of the prostate. Various examiners over a 2 year period entertained the diagnoses of carcinoma of the prostate and seminal vesicle, or prostatic calculi, the latter being the favored impression. In 1934 the patient developed hematuria and back pain. Roentgen examination revealed destructive vertebral and rib lesions. The patient died within a few months following the sequence of cystitis, pyelonephritis, and uremia. At autopsy, primary carcinoma of the seminal vesicles was found, histologically forming columns of small vesicular cells. There was no invasion of the prostate but the tumor growth involved the bladder wall about the ureters.

Case 2 was that of a 36 year old patient who, in December, 1946, complained of lower abdominal pain radiating to the external genitalia. Treatment for seminal vesiculitis was unavailing and the patient had a weight loss of 25 pounds in a few months. In April, 1947, a firm nodular mass 3 inches in length above the prostate on the left was considered tuberculous. There was a rapid downhill course following laparotomy in June, 1947 at which time there was considerable fluid in the abdomen, and biopsy sections of the hard mass above the prostate revealed a highly anaplastic tumor consisting of large polyhedral hyperchromatic cells. The patient died, but an autopsy was not performed.

In the second case the tumor was obviously inoperable when first seen. The report of the first case, however, is instructive in emphasizing a well established urological dictum. Even in the absence of symptoms, when a small suspicious mass in the prostate or vesicle is found, consideration should be given to exposure through the perineum and biopsy by frozen section, with a view to radical excision, if it is cancerous. ALLAN K. SWERSIE, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Evolution and Causes of Juengling's Disease (Evoluzione ed esiti della malattia di Juengling). G. GHERLINZONI. *Chir. org. movim.*, 1948, 32: 20.

The author presents a supplementary report of a case of Juengling's disease reported by him 7 years previously. The symptoms occurring in this condition are known as the Besnier-Boeck-Schaumann syndrome (benign lymphogranulmatosis, benign diffuse reticuloendotheliosis) which, in the skeletal system, forms the disease of Juengling (cystoid osteitis tuberculosis multiplex).

Comparative films taken in 1940 and 1947 are shown of the shoulder girdle and the feet. There has been definite improvement of the cystic areas in the intervening 7 years.

The patient whose case is reported was employed as a housemaid, and presented herself after an interval of 7 years because of increased osteoarthritic manifestations of the shoulders and hips.

The author explains that the condition is seen only rarely in Italy. In conclusion he stresses the following points:

The clinical condition is a definite entity in the skeletal system.

In spite of the fact that the condition is considered benign, as far as healing of the cystic areas is concerned, the associated osteoarthritic condition is progressive. CARLO SCUDERI, M.D.

Muscular Torticollis. FREMONT A. CHANDLER. *J. Bone Surg.*, 1948, 30-A: 566.

This article is based upon a study of 225 patients with muscular torticollis (101 of these cases had been previously reported).

The accepted theories and the literature on this subject are quoted, and it appears that most writers have agreed that the tumors of the sternomastoid muscle are hematomas, caused by tearing of the muscle during birth, often in breech presentations. The author believes that malposition in utero with possible pressure and ischemia of the sternomastoid may render the muscle atrophic, maldeveloped, fibrous, and shortened, and therefore liable to damage during delivery.

The treatment advised in older children is detachment of the sternal and clavicular heads of the sternomastoid muscle, followed by retention in an overcorrected position. In the infants (42 infants under 1 year are included in this series), even when only a few weeks old, the author believes excision of the fibrous tumor, followed by the application of a light plaster splint to maintain the overcorrection for 3 to 4 weeks is justified. The operation is not difficult, but the spinal accessory nerve must be protected and disengaged from the tumor.

Microscopic section of the tumor, which is white and fibrocartilaginous, shows abundant fibrous replacement of degenerating muscle fibers, and no evidence of hematoma at all, even in very young infants. There was no blood clot or residual blood pigment observed. NEWTON C. MEAD, M.D.

Coxa Plana. M. BECKETT HOWORTH. *J. Bone Surg.* 1948, 30-A: 601.

The author reports on 115 cases of coxa plana seen at the New York Orthopaedic Hospital between 1935 and 1944.

Coxa plana is a self-limited disease of the hip, of unknown etiology, usually occurring between the ages of 4 and 10 years. The name is not altogether satisfactory but is the best so far suggested. The author believes that the term "aseptic necrosis" is not accurate and should be discarded. It is one of a group of diseases, the osteochondroses, which include slipping of the upper femoral epiphysis, coxa magna, Osgood-Schlatter's disease, apophysitis of the calcaneus, and Koehler's, Freiberg's, Kienbock's and Scheuermann's diseases. They are all characterized by degenerative changes due to circulatory disturbance, but occur at various ages and in various epiphyses or small bones.

Eighty-five per cent of the cases encountered occurred in boys, and 90 per cent were unilateral. Either hip may be affected. The physical type of the child appears to have no relation to the disease, and an occasional patient presented a definite endocrine disturbance. Coxa plana may occur during the course of treatment of congenital dislocation of the hip in about 25 per cent of the hips, as a result of immobilization in a position of tension, particularly extension, abduction, and internal rotation. This position "wrings out" the blood vessels and interferes with the circulation resulting in degenerative changes.

Pathologically, there is swelling, edema, and hyperemia of the soft tissues, capsule, periosteum, and, especially, of the synovial membrane. Microscopically, there is edema, hypervascularity, and thickening of the synovial membrane, often with villous formation. Perivascular lymphocytic and plasma cell infiltration is usual.

The disease may be divided into four stages: (1) the early or incipient stage, in which there are only soft tissue changes and mild symptoms and signs associated with synovitis; (2) the degenerative or active stage, lasting 1 or 2 years, in which degeneration in the head and softening at the epiphyseal disc occur; (3) the healing stage, lasting 3 or 4 years, in which the dense areas are replaced by granulation tissue and finally by normal bone; and (4) the residual stage, in which only the deformity with its consequent symptoms remains. In each stage the soft tissue changes precede the bone changes.

In the early stage, the most common symptom is a slight limp, which increases with the intensity of the disease. Pain is rarely severe enough to prevent walking; often it is only a mild ache or stiffness. It is relieved by rest, aggravated by activity or injury, and referred to the groin, medial aspect of the thigh, or knee, following the distribution of the obturator nerve. The acute symptoms gradually subside and are replaced by symptoms due to faulty mechanics associated with the deformity. Eventually, the symptoms of osteoarthritis may supervene. The earliest and most important signs are limp, limitation of motion, and pain at the extremes of motion, especially lateral motion and rotation. In time, slight atrophy of the thigh and slight shortening of the femur occur because of the flattening of the head and shortening of the neck.

Laboratory tests are of only incidental value in this disease. The first evidence of the disease in the roentgenograms is a globular swelling of the capsule. The joint space appears wider medially because of a slight lateral subluxation. It appears wider superiorly, because of a flattening of the ossified portion of the epiphysis. Soon after the onset, the epiphyseal line appears wider and is irregularly decalcified at its junction with the neck. An irregular dense area soon appears in the capital epiphysis, usually in the central portion. Gradually the dense area becomes irregularly decalcified, but it may enlarge at the same time. During the decalcification, the head becomes wider, flatter, and thinner, and the neck becomes thicker and shorter. Gradually the soft tissue swelling subsides; the epiphyseal line recalcifies, while the proximal surface of the neck becomes convex and grows into the head. More gradually, the decalcified areas are recalcified. Eventually normal trabeculation occurs, but the head maintains its mushroom shape and tends to remain subluxated.

In untreated cases, coxa plana follows a characteristic course over a period of from 4 to 7 years, and always heals, but with some residual deformity.

The primary treatment for the disease at the present time is rest. Rest in bed is the surest and simplest way of securing rest for the hip, but it must be continued for 2 or 3 years from the onset in the average case. It was used alone in 30 cases of this group. It is especially important in the incipient stage, when the symptoms and signs are acute, and, later, when there is a great deal of decalcification of the head. Traction for 2 or 3 weeks is desirable for the relief of pain and spasm but it should not be prolonged. Rest should be continued until there is no pain or spasm with motion, and until the roentgenograms show sufficient regeneration of the head for safe weight bearing.

The best ambulatory treatment is obtained by the use of a sling and crutches; this method was used in about 20 cases of this series. A webbing belt with a shoulder strap, similar to the Sam Browne belt, is used for the sling which is suspended from the belt and encircles the ankle. The lower extremity is thus suspended with the hip and knee in flexion. The nonweight bearing long leg brace with a built-up shoe for the good side may be used, but it is heavy and clumsy, more expensive, and less satisfactory. Crutches alone may be used, but generally the child cannot be depended upon to keep his weight off the extremity. Immobilization in a plaster cast or traction brace tends to increase the limitation of motion, especially if continued for weeks or months, but it may be used for 2 or 3 weeks for the relief of acute pain and spasm.

The drilling operation was used in about 50 cases from 1928 to 1939 for hastening the healing of the disease process. The follow-up period extended from 8 to 18 years. The operation has been found most useful when performed in the progressive stage or in the early stage of repair. The total amount of degeneration and the residual deformity appeared to be reduced by this procedure, and the period of convalescence has been shortened by about one-third. No new degenerative areas appeared, and repair began promptly after the operation. In order to be most effective, the operation must be combined with a period of several months of nonweight bearing. Better results were obtained in the group of patients operated upon than in the other group.

JOHN J. CRANLEY, JR., M.D.

Histologic Studies on Arthritis Deformans of the Hip Joint. Alterations in the Osseous and Cartilaginous Fibrillary Framework. Studies in Polarized Light (Ricerche istologiche nell'artrosi deformante dell'anca. Le alterazioni della trama fibrillare cartilaginea ed ossea. Ricerche in luce polarizzata). PAOLO LUGIATO. *Chir. org. movim.*, 1948, 32: 201.

On the basis of the material procured in doing arthrodeses of the hip joints in 15 patients with arthritis deformans at the University of Milan, the author discusses the results. Microscopic sections of from 16 to 20 microns in thickness were studied with Nicol prisms as the source of the polarized light. The microscope used was the Koristka "Euskop," with an achromatic objective 2.2x—5x—45x, and a Huyghens ocular 6x and 8x. The polarizing apparatus was the homocentric condensator produced by Koristka. In addition to the simple exposures with the crossed Nicol prisms, every specimen was also examined by the chromatic method, by inserting between the two prisms a compensator provided by Koristka which consisted of a slab of mica of the proper thickness. The procedure is the same as that used by mineralogists in the study of rock crystals.

It is shown that by this method not only the shape and course of the fibers composing the lamellae of the cartilage and of the bone—for the manner of doubly refracting the polarized light by the fibrils in the cartilage differ entirely from that of the osseous elements—can be demonstrated, but also that changes in their arrangement and composition can be detected before anything abnormal can be seen with the ordinary staining methods of study. It

can be shown how the interlacing fibrils of the surface layer of transversely directed elements first become altered in their capacity of transmitting the polarized light waves and finally lose the power of response and disappear. Next the middle layer of arcuate fibrils are affected and finally, the deeper layer of radial fibrils. The subchondral osseous elements then invade the deeper portions of the cartilaginous elements, and finally become eburnated and substitute for the undermined and destroyed cartilage. The behavior of the polarized light in some of these stages is not explainable by our present knowledge of optics and is merely cited by the author as a suggestion for future research in this field.

The findings by this method were finally checked by ordinary dark-field illumination methods, and these findings were deemed sufficiently accurate to dispense with the ordinary staining methods.

The author hopes to use this method, not only for the study of arthritis deformans of the hip joint, but of other joint troubles as well.

JOHN W. BRENNAN, M.D.

General Concepts on Traumatic Parameniscitis of the Knee (Parameniscitis traumática de la rodilla; conceptos generales). HECTOR DAL LAGO. *Rev. ortop. traumat.*, B. Air, 1948, 17: 244.

The parameniscus is the space about the meniscus containing blood vessels and nerves. It is believed to be the only part involved in any inflammatory process. Parameniscitis occurs as the result of trauma to the meniscus, with or without rupture, or trauma directly to the parameniscus without involvement of the meniscus. Strain or compression of the semilunar cartilage, with or without fracture, may cause injury to the periarticular structures and produce edema, vascular and tissue proliferation, pain, and swelling. It is contended that these constitute the ruptured meniscus syndrome. The same sequence, however, may occur without damage to the semilunar cartilages.

Parameniscitis may be acute or chronic, and treatment is rendered accordingly. The condition may regress spontaneously or persist through the chronic stage to cystic degeneration and necessitate resection of the meniscus. STEPHEN A. ZIEMAN, M.D.

Radiological and Histological Studies on the Aseptic Osteolysis which is Associated with Vascular Disturbances, with Exceptional Report of a Familial Case of Total Loss of Bone of One Toe of a Foot with Symmetrical Atrophy of All the Other Toes (Contributo radiologico ed istologico alle osteolisi asettiche accompagnantisi a turbe vasomotorie eccezionale reperto a sfondo familiare di totale scomparsa dello scheletro di un dito del piede con atrofia ossea simmetrica di tutte le altre dita). GIUSEPPE TONIOLO. *Chir. org. movim*, 1948, 32: 52.

The author describes in detail the case of a woman who presented, since the age of 12, a vasomotor syndrome of all of the toes of the feet. Roentgenographically it was possible to demonstrate a marked atrophy of all the phalanges and total absorption of all the bones of one toe. Such changes must have had a familial background, because a sister of the patient presented a very similar clinical picture. The author does not enter into a discussion of the differential diagnosis; however, he believes that the syndrome simulates Raynaud's disease.

The author describes in detail the histological changes observed in the patient and the gradual change of the bone to connective tissue, also the complete absence of any regenerative action of bone. This gradual change of bone to fibrous tissue is the usual change observed in neurotrophic bone lesions. However, this was an unknown clinical picture because there was no resulting gangrene which is the usual complication in this type of case.

The patient was a woman of 32 years of age whose only abnormal background was pulmonary tuberculosis which had been treated for 2 years by pneumothorax. She gave a history of having always complained of cold hands and feet. Detailed laboratory findings are given and the history and photograph of the sister's foot.

The author gives a review of the bibliography and differential diagnosis. Histological studies were made of a biopsy specimen corresponding to the interior of the fourth toe of the left foot. Microscopic sections showed a fibrotic tissue in various stages of regeneration. The blood vessels showed a cellular hyperplasia of the intima. There was no evidence of thrombosis, necrosis, or exudative phenomena.

CARLO SCUDERI, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Cup Arthroplasty of the Hip. WILLIAM H. BICKEL and FRANK S. BABB. *J. Bone Surg.*, 1948, 30-A: 647.

Detailed analysis of cases of cup arthroplasty of the hip revealed that patients should be selected carefully for this operative procedure on the basis of (1) physiologic age, (2) temperament and ability to cooperate, (3) reconstructive possibilities of the hip, as analyzed from roentgenograms, (4) muscle power, and (5) occupation.

All patients should be acquainted with the possibilities of failure and success, and the alternate operations should be discussed with them. In case of disease of both hips, or in cases in which degeneration of the opposite hip is expected, there is no alternative. Drilling operations, cheilotomy, fascial arthroplasty, and other methods have not stood the test of time. Osteotomy to change the weight-bearing surfaces of an already incongruous and worn-out joint does not seem reasonable. Neurectomy of the obturator nerve may help. It has not proved of great help in relieving persistent pain following cup arthroplasty; however, the number of cases in which it has been done by the authors is not great.

Prostigmine has been used after operation in some cases to relieve muscle spasm and pain. The results were not very encouraging, although several patients believed that it helped considerably. Curare has

been used in conjunction with physical therapy in a few cases to obtain muscle relaxation, with equivocal results thus far.

Some of the best results obtained have been in cases in which the degenerative process or mechanical irregularity of the head of the femur was in the formative stage and the acetabulum was involved only mildly. It is difficult to advise early operation for a patient who has distortion of the hip joint without much pain, although one knows that ultimately the hip will break down. Perhaps in these cases, cup arthroplasties should be done before secondary osteoarthritis develops.

Comparison of the results recorded prior to January, 1943, in the 88 cases in which cup arthroplasty was carried out at the Mayo Clinic, with the results recorded in these same cases in this report, reveals a slight trend toward improvement. In 19 cases in which unilateral cup arthroplasty had been performed prior to 1943, improvement had occurred in the past 3 years as follows:

In 6 cases results which were poor at the time of the first study had become fair; in 6 cases fair results had changed to good, and in 1 case fair results had become excellent. In 6 cases results which were good earlier had become very good. In 10 cases the results had become worse; in 5 of these cases lucite cups had been used. The lucite cups in 3 of these cases are known to have fractured; 1 patient had a late abscess. No reason could be found for the downhill course of the remaining 6 patients. Results in 4 cases changed from fair to poor; in 3 from good to poor (lucite cups); in 2 from good to fair; and in 1 case from very good to good.

It is the authors' impression that, as the patients gain confidence and muscle strength, the motion in their hips generally becomes better and the pain becomes less. A table is included to illustrate the over-all trend in all cases in which follow-up information was available.

Those opposed to cup arthroplasty will focus their attention on the percentage of poor results. It must be remembered, however, that the patients were severely disabled before operation, and that the percentage of salvaged individuals far outweighs the percentage of those who have been made no better.

From this study it seems safe to conclude that vitallium-cup arthroplasty of the hip is a procedure which offers relief from pain, increased motion, and correction of deformity to a great number of patients. The results cannot be positively predicted, but better selection of patients and improvement in surgical technique should increase the percentage of good results from this surgical procedure.

Osteomyelitis of the Fibula (Le osteomieliti del perone). V. Accardi. *Chir. org. movim.*, 1948, 38: 133.

Twenty-three cases of osteomyelitis of the fibula were observed during the period from 1941 to 1946 at the Orthopedic Center of V. Putti, at Bologna, Italy. In 17 patients, more or less extensive resections of the fibular diaphysis was done. In the remaining 6 patients conservative measures (immobilization) were employed. The latter patients were not subjected to resection because there was not much disruption of the bone and no evidence of a tendency of the infective process to spread throughout the entire diaphysis.

The periostium was always removed with the bone in the resections. This was done routinely because all of the patients were adults and the regeneration of new bone was not a factor, and because it was feared that the periostium, if retained, might result in the production of an osteomyelitic process in the newly formed bone itself. Care was exercised to carry the resection far enough into healthy bone tissue so that there was no danger of leaving infected bone in the stumps. As much of the lateral malleolus as possible was left intact—at least a few centimeters of the lower end of the fibula—in order to avoid the danger of infection of the tibiotarsal joint, and the development of an eversion deviation of the foot.

The results of treatment in every instance were excellent. Cure was attained in the course of 2 or 3 months. Only in 1 case was cicatrization delayed for 8 months. In 1 patient the wound had to be reopened 9 months later to remove a small sequestrum at the upper end of the distal stump. In a third individual a tubular transplant of skin was made to help close the extensive open wound.

On the basis of his experiences with this material the author feels justified in proposing that in the cases of comminuted fracture resulting from gunshot wounds with extensive lesions of the soft parts the diaphysis of the fibula should be resected at once.

John W. Brennan, M.D.

Open Reduction of Pes Varus in Young Infants (La reduction sanglante du pied bot chez le jeune enfant). Jacques Leveuf and Pierre Bertrand. *Rev. orthop.*, Par., 1948, 34: 97.

A closed reduction of pes varus may be unsuccessful because (1) certain forms, especially those associated with other malformations, are irreducible, (2) the treatment is instituted too late, or (3) the correction is insufficient or is not maintained.

True recurrences are rare, the great majority of recurrences being due to incomplete reduction combined with an insufficient osteogenesis.

If the conservative treatment fails or the condition recurs, tenotomy of the Achilles tendon and an application of a plaster of Paris cast are usually done. The procedure frequently produces an incomplete correction and weakens the triceps muscle. Furthermore, peritendinous adhesions not infrequently form. A prolonged immobilization may be followed by muscular atrophy and articular stiffness. Moreover, a first reduction may produce grave osteogenic deformities, such as flattening of the astragalus or convexity of the sole. Such deformities are favored by decalcification of the bones caused by immobilization of the involved extremity in a cast prior to the renewed reduction. Therefore, the authors condemn repeated efforts at reduction and recommend in their

place an operative intervention directed chiefly toward the ligaments and tendons.

Two types of conservative open reduction are employed by the authors: (1) a limited operation, reserved for an isolated residual pes equinus usually observed within the first 2 years of life, and (2) extensive operations in cases with complicated malformations, such as pes varus, pes equinus, metatarsus varus, which are usually found after the first 2 years of life.

The first type of operation consists of an elongation of the Achilles tendon, posterior capsulotomy, and transcalcaneal traction. The more extensive operations may be subdivided into two groups: operations on the anterior and operations on the posterior parts of the foot. In the last type the Achilles tendon is elongated, the internal malleolus is severed in an oblique direction from above downward and from the inner toward the outer side, and the posterior tibial and flexor tendons are elongated according to the needs.

Slight deformities of the anterior portion of the foot may be treated in the same manner, while more pronounced deformities require a supplemental second stage operation consisting of section of the internal plantar muscles. The posterior tibial tendon must remain untouched but the plantar aponeurosis may require sectioning.

The affected extremity remains in the cast for 3 months.

Sometimes the operations must be supplemented by cuneiform external osteotomy of the anterior apophysis of the os calcis or the cuboid. In children older than 4 years a transplantation of the anterior tibial tendon to the lateral border of the foot may be required.

Of 76 children, 15 could not be followed up, while 20 were operated on recently. Of the remaining 41, 26 underwent a bilateral operation. Good results were obtained in 25 patients, 13 of whom were operated on on both sides. JOSEPH K. NARAT, M.D.

The Indications and Technique of Surgery of Bone Tumors (Indikation und Technik der Knochengeschwulstoperation). HANS HELLNER. *Chirurg*, 1948, 19: 97.

This article is a brief survey of the most important methods employed in the surgery of bone tumors.

Biopsy is necessary in all doubtful cases. It should not be done with the curet but rather with a bone knife or chisel because curettage does not produce good specimens for histologic examination.

Curettage is in most cases sufficient for the treatment of cysts, giant cell tumors, and chondromas. If a large cavity remains after removal, the defect should be filled with bone grafts.

Removal with the chisel is practicable only in exostoses, osteochondroma, and osteoma of the cortex. The periosteum should be removed with the tumor to prevent recurrences.

Resection of the bone together with the tumor is the operation of choice for all benign tumors. If only a part of the bone circumference is involved in the tumor, partial resection is sufficient. Total resection in long bones always calls for subsequent bone transplantation to restore the continuity.

The methods of plastic bone operations are:

1. The graft is taken by shifting a piece of bone from the contiguous portion of the same bone. This is possible only in partial resection of long bones. The solidity of the bone is always jeopardized by this procedure.

2. The graft is taken from the tibia, fibula, iliac crest, or rib. The chisel should be used rather than the saw because the heat produced by sawing damages the bone tissue. Either bone chips or a single large piece of bone may be used. In cases in which a large portion of the shaft of a long bone has to be resected, a Kuentscher nail or a Kirschner wire can be used to support the transplanted bone. No foreign body reactions were observed following this procedure. Bones which do not have to bear weight should be resected radically when affected by an osseous tumor. The author removed the entire occipital bone in a giant cell tumor, the supraspinal part of the scapula, the iliac wing, and the arches and transverse processes of vertebrae.

Primary malignant bone tumors should always be treated by amputation. Resection, even in early cases and small tumors, leads almost inevitably to fatal recurrences and metastases.

Bone metastases of malignancies in other organs are very frequent. In persons over 40 years of age, these secondary malignancies are the most frequent of all bone tumors. Usually they are inaccessible to surgery; however, there are three exceptions to this rule: single metastasis of a struma, single metastasis of a Grawitz tumor, provided the primary tumor had been extirpated years ago, and the pathologic fracture of the femoral neck due to cancer metastasis. The first 2 can be treated by radical surgery as for primary tumors with a good prospect of success. In the case of the pathologic fracture of the femoral neck, operation will not save the patient, but internal fixation with a nail is indicated to relieve his pain and to get him out of bed.

Unbearable pains in vertebral metastases or in inoperable primary tumors with pressure on nerve plexuses are treated very successfully by chordotomy. WERNER M. SOLMITZ, M.D.

FRACTURES AND DISLOCATIONS

Recent Advances in the Field of Medullary Nailing. GERHARD B. G. KUENTSCHER. *Ann. chir. gyn. fenn.*, 1948, 37: 115.

Eight years have passed since medullary nailing was first done. The recent war has provided excellent opportunities to judge how far the procedure has come up to expectations and on what lines it has developed. Originally the method was inaugurated for the treatment of fresh fractures.

Medullary nailing ensures early movement and good fixation, abolishing the drawbacks and dangers

of immobilization. Postoperative treatment is not needed at all and hospitalization is therefore greatly shortened. The follow-up in 22 cases of fracture of the lower leg showed that there was no limitation of motion in the neighboring joints, and in only 1 case was there noticeable waste of muscles. Except in 2 cases, no edema of the lower leg nor disturbances in blood circulation could be noted. In 18 fractures of the humerus, hospitalization averaged 11 days. All of the patients showed osseous union. The period of recovery was similar in 16 patients with fractures of the forearm. Many of these patients were able to do light work 7 days after the operation.

The only danger in medullary nailing is the danger of shock. A safe principle to follow is that no medullary nailing operation should last longer than an hour. The risk of infection is not very great because the fracture itself is not exposed and it is not in contact with the hematoma of the fracture. The nail is introduced through stab incision far from the site of fracture. There is a risk of infection at the point at which the nail is driven in but this infection does not progress along the nail if the threads are removed, i.e., it does not lead to infection of the fracture. Should an infection set in, it would be a mistake to pull out the nail. The great advantage of medullary nailing is that it prevents even the slightest shaking motion of the fracture and this complete absence of motion is absolutely necessary for the healing of the infection. The fracture and site of introduction of the nail have to be opened, the pus flowing out through the introduction hole and the nail itself acting as a drain. Bone infection in medullary nailing is absolutely typical. It does not lead to osteomyelitis but to local osteitis which also may lead to a characteristic sequestrum. This sequestrum does not affect healing because callus always grows around it. After the extraction of the nail, the sequestrum is easily removed. As the results presented in this article were obtained without penicillin, there is reason to expect that the results will be a great deal better in the future.

The presence of abscesses, furuncles, and previous wounds is an absolute contraindication for medullary nailing of a simple fracture.

Fractures of the distal third of the tibia can be firmly united only by means of a spreading nail on account of the conical widening of the distal third of the bone. The spreading nail has also been approved for treatment of fractures of the neck of the humerus. The nail is introduced a little above the olecranon and fills the cavity along the whole length of the shaft.

For the treatment of pertrochanteric fractures Y-shaped double nails have been used with success. This type of nail can be introduced via two stab incisions. Ambulation is possible after a fortnight.

Nailing of a simple fracture is done under fluoroscopic control. After the hematoma and edema have been massaged away the bone can be well felt under the skin. By taking it between two fingers reduction is done exactly. After this, Kirschner wires, with the end ground off, are introduced into the medullary space. When the wires leave the marrow space at the fracture a slight resistance of the muscles can be felt. The nails are driven in along the wires, after which the wires are extracted.

Medullary nailing is of great value in other fields of bone surgery, especially in osteotomy. It is not a mere substitute for the customary methods; it also helps to protect the periosteum and this is essential for nourishing the bone. Medullary nailing has also been accepted in the shortening of limbs, which, by this method, can be done exactly and with no appreciable risk. The writer recommends his counter-incision saw for cases of this kind.

The author lists other conditions successfully treated by this method and concludes by stating that it should be attempted only after a study of the method at a hospital with a long experience in medullary nailing. RUDOLPH S. REICH, M.D.

Additional Data Observed in Kuentscher Intramedullary Nailing at the Surgical Clinics of the University of Kiel (Weitere Erfahrungen mit der Marknagelung nach Kuentscher an der Chirurgischen Universitaetsklinik Kiel). HEINZ GRIESSMANN AND WILHELM SCHUETTMEYER. *Chirurg*, 1947, 17-18: 316.

This article is based on 155 cases of intramedullary nailing observed between January 1, 1944 and January 5, 1946. Fractures of 49 thigh bones, 64 lower leg bones, 14 humeri, and 28 tibiae were treated by intramedullary nailing. This procedure was used in children only when conservative, well established methods failed.

There were 46 simple fractures of the lower leg bones of which two-thirds were in the lower third of the tibia, less than one-third were in the midportion of the bone, and 4 were double fractures. It was necessary to use a different type of nail (Doppel-Nagel) in the treatment of the oblique fractures. The so-called "Spreiz-nagel" gave very satisfactory immobilization and only occasionally a plaster cast had to be used for a short period. It was necessary that the nail maintained rigid fixation to counteract the push and pull forces and that callus formation was not impaired.

The operation was carried out by the technique described by Boehler. A small incision was made over the tibial tuberosity. By placing the part into the Boehler apparatus reduction was accomplished with only a little external help and the operation required, as a rule, from 10 to 15 minutes. In cases in which the marrow cavity was narrower than the nail (especially in the midportion of the bone) the intramedullary nail was reinserted through the medial malleolus.

In simple fractures, ambulation of the patient was determined by his general condition. As a rule, patients were allowed to get up after the wound had healed. In the absence of any hematoma and any additional injury the patient was allowed to get up after the fifth day. Weight bearing was allowed after

the twenty-fourth postoperative day and the average patient was able to return to work within 3 months. The nail was removed only after visualization of firm callus formation on x-ray examinations, and under no circumstances was the nail extracted sooner than 3 months. In 3 cases there was delayed union of the fracture, and resection of the fibula was necessary. This procedure was contemplated only after 8 to 12 weeks of delayed union. After resection of the fibula a plaster cast was used.

Intramedullary nailing was done in 15 compound fractures, and in 7 cases the fracture united without any complications. Osteomyelitis was not observed.

There were 4 types of callus formation seen in routine x-ray examinations: (1) "cloudy" callus; (2) scanty callus formation with early and solid union; (3) callus formation predominantly on one side; and (4) extensive reaction of the periosteum. The cloudy type of callus formation occurred quite early in the healing of fractures and in the presence of small fragments at the fracture site, but only in fractures of the femur. The second type of callus formation was usually seen in fractures treated by nailing and in cases of ideal reduction. The callus formation on one side was seen in cases in which there was rotation of the bone fragments. Callus formation apparently was guided by laws of mechanics, i.e., pressure forces increase callus formation, distraction inhibits callus formation. In cases of angulation at the fracture site, callus forms on the concave side of the fracture. Increased periosteal reaction was usually observed in children and adolescents.

There were 2 cases of pseudarthrosis of the tibia treated with intramedullary nailing. One of the fractures was near the ankle joint. The fracture site was freshened up and an intramedullary nail was introduced. In one case infection developed and the patient was treated along conservative lines with plaster of Paris casts. In the second case the fracture site was freshened up, the nail introduced, and the wound was left open with satisfactory results. The intramedullary nailing was complicated in one case by the fact that the nail broke, and in the second case an oversized nail was used. It is important to select the nail very carefully. In case one is in doubt one should choose the thinner nail. The nail should enter the medullary canal about 2 centimeters with each blow. Once the nail was firmly impacted it was almost impossible to remove it. It is better to cut the protruding portion of the nail off once it is impacted instead of trying to remove it *in toto*. The double nail was used in only very few cases. If the nailing was done correctly no additional immobilization was necessary and the results were excellent.

Patients were discharged on the average after 3.5 months. There was no muscle atrophy or limitation of motion of the joints. There was one death. One nail in the femur had to be extracted. The nail was so firmly inserted that the greater trochanter had to be chiseled out. The patient developed a generalized infection and died. In 7 cases of compound fractures of the femur the healing occurred without any complication. In 3 cases complete healing of the soft tissue parts preceded the operation. Intramedullary nailing of the femur was done in 4 cases of tumor and metastases of the bone. Within 10 days the patients were able to walk without any discomfort. The same procedure was also used with good results in osteotomy of the femur.

Intramedullary nailing of the humerus was done through the olecranon fossa or through the greater tuberosity. Nailing was done in 10 fractures of the humerus, 2 of which were pseudarthroses, and 1 fracture with metastasis to the humerus. The average hospitalization was 10 days. As a rule there was only a small amount of callus formed along the fracture site.

There were 28 cases of fracture of the radius and ulna which were treated by intramedullary nailing, 16 of which were closed fractures, 2 compound fractures, and 10 pseudarthroses. Some patients resumed heavy work 4 weeks after operation and the nail broke. In nonunion of the ulna and radius, bone grafts from the tibia, ribs and fibula were used in addition to nailing. All of the bones healed satisfactorily. The nailing of the bones of the forearm is the most difficult. In a great many cases the fracture site had to be opened. In only one case was an amputation necessary following introduction of an intramedullary nail, because of widespread chronic osteomyelitis of the entire shaft.

GEORGE I. REISS, M.D.

ORTHOPEDICS IN GENERAL

Hematogenous Osteomyelitis in the Child (Osteomielitis hematogena en el niño). HELMUT W. JAEGER. *Arch. Soc. cir. hosp.*, Santiago, 1948, Supp. 16: 115.

From January, 1945 to June, 1947, the author has observed 65 cases of hematogenous osteomyelitis in children, of which 35 were acute and 30 were chronic. Eleven of the patients were up to 3 months old, 2 were from 3 months to 2 years old, and 52 patients were more than 2 years old. In from 85 to 90 per cent the causal organism was the Staphylococcus, generally of the aureus hemolyticus type. Age seemed to be a predisposing factor (below 3 months and between 5 and 15 years), and males were involved two or three times more often than females. The disease has a special predilection for the femur and the tibia. The initial osteomyelitic focus is found in the metaphysis and the diaphysis, but rarely in the epiphysis. At this point the bacteria cause an inflammatory process which develops in the connective tissue of the bone ducts and cavities; the exudate becomes rapidly purulent and spreads gradually following the route of minor resistance. The growth cartilage offers some resistance to the infection, but when this is overcome the epiphysis and the joint may become involved.

The acute process gives rise to a series of changes which acquire their full development in the chronic

period. The destructive changes are (a) resorption, atrophy, and rarefaction of bone, and (b) necrosis of bone and sequestrum formation. The productive changes are (a) new formation of bone, and (b) sclerosis of the bone. Passage from the acute to the chronic period is gradual and the latter is characterized by the persistence of fistulas and sequestra which keep up the suppuration.

The onset of acute osteomyelitis may be violent or preceded by a prodromal stage of several days with weakness, loss of appetite, rheumatic pains, or urticarial rash. Local and general symptoms vary in severity from case to case and three clinical forms are recognized: localized, hyperacute toxic, and septicopyemic. Under no circumstances should the result of laboratory examinations be awaited before instituting treatment, since more than 90 per cent of the bacteria are penicillin sensitive. When the body has failed to overcome the infection, the disease passes into the chronic stage. The following complications were observed in the 65 cases: arthritis in 12 (hip 9, shoulder 2, ankle 1), pathologic fracture in 4 (tibia 3, femur 1), purulent pericarditis in 2, and tibia vara in 1. In the nursling, osteomyelitic arthritis of the hip evolves with a characteristic clinical symptomatology; pathologic luxation from destruction of the femoral head is the rule and can often be corrected only by a reconstructive operation.

The earliest roentgen signs appear from the seventh to the tenth day, but sometimes only between the fifteenth and twentieth days; and from the fourth or fifth day in nurslings. Small irregular zones of reduced density appear in the bone and, while spreading, assume a porous, moth-eaten, speckled aspect because of decalcification, resorption, and destruction of the trabeculae, and thinning or perforation of the cortex. In the second or third week subperiosteal new bone is formed, always less dense than that of the cortex. In chronic osteomyelitis the necrosed bone is denser than the neighboring bone after 3 to 6 weeks, and a line of demarcation appears between the living and dead bone. The sequestrum is usually surrounded by a clearer halo.

Treatment may be general or local; the general type consists of chemotherapy with penicillin, sulfonamides, or streptomycin, hydration, alimentation, and transfusions; the local type, of immobilization, surgical interventions, and local chemotherapy with penicillin or streptomycin. The two most urgent considerations are the administration of penicillin and immobilization. To be efficacious, penicillin treatment must be started early, with adequate dosage, and continued without interruption for a sufficient time. The author uses an aqueous solution of sodium penicillin intramuscularly in the following dosage: from 20,000 to 30,000 units every 3 hours in children below the age of 2 years; from 30,000 to 100,000 units every 2 to 3 hours in older and adolescent children. The daily dose may also be calculated from the weight of the child: from 20,000 to 30,000 units per kilogram. The treatment generally takes 3 to 4, or more weeks, and the dosage is reduced gradually as improvement becomes evident. Immobilization must be instituted as soon as the diagnosis is suspected, and must be maintained until the bone shows satisfactory resistance. The treatment of acute recurrence in chronic osteomyelitis is the same as that for acute osteomyelitis.

In the radical treatment of chronic osteomyelitis, penicillin is started from 2 to 4 or more days before intervention which will consist of curettage, sequestrectomy, and canalization (saucerization), or subperiosteal diaphysectomy, according to the case. The ideal procedure is then to cover the open bone with a thick layer of soft tissue and to close the skin without drainage. A Nélaton sound is introduced through a small counter opening to instill penicillin. In extensive loss of soft tissues a plastic procedure may be necessary. Residual bone cavities are filled with bone chips and covered with a pedicled skin graft.

With penicillin treatment the mortality of acute osteomyelitis has fallen to from 0 to 1.5 per cent. In the 35 acute cases of the present series there has been no fatality. Although it is too early to speak about permanent cure, healing was obtained in more than half of the cases when penicillin treatment could be started between the first and fifteenth days of the disease, the average treatment starting before 6.9 days. The cases which were admitted between the seventh and thirtieth days (average of 15.6 days) became chronic. In 16 of 29 controlled cases it was necessary to incise a subperiosteal or soft tissue abscess; hospitalization ranged from 8 to 90 days, with an average of 33.17 days. In chronic osteomyelitis it is even more difficult to evaluate results; however, they were frankly encouraging, especially in cases in which bone grafts were used.

The evolution and duration of the disease in the nursling are shorter because of the greater speed of the processes of resorption and reconstruction of the bone; the average duration is 2 months. In general, the septicemic symptoms predominate over the bone symptoms; however, a septicemic and a pure osteomyelitic form can be distinguished. With penicillin therapy there was no fatality among the 13 cases observed. The prognosis for the bone lesion is good, as healing is usually rapid, complete, and final. However, if the joint or the growth cartilage has been involved, shortening of the extremity, changes in the growth of the axis (genu valgus or varus), and pathologic luxation may occur. RICHARD KEMEL, M.D.

Applied Musclephysiology in the Healing and Treatment of Fractures (Angewandte Musclephysiologie beim Knochenbruch, seiner Heilung und Behandlung). E. REHN. *Chirurg*, 1946, 17-18: 14.

The author believes that both clinical observation and experimental evidence suggest that the muscles play an important role in the healing of fractures. The primary process in the formation of callus has been thought to be hyperemia in the area of the fracture. Rehn, however, believes that this hypere-

mia is of only transient appearance, and usually disappears in about a week. On the other hand, the status of the muscles surrounding the fracture, their irritability, and their other physiological responses closely parallel the healing of the fracture.

Immediately or soon after the fracture has occurred there is a lack of response in the muscles of the injured area which the author calls "muscle torpor." After a week, however, the muscle displays increased irritability, which he terms "intermittent tetanus." It is in this stage that the callus is deposited. The muscle furthermore acts as a guide to the correct reposition of the fractured bone ends. Therefore, it serves a useful purpose, and only occasionally does its interposition between the fragments cause difficulty.

For this reason the muscle should be treated with respect. Severe distraction will soon cause muscular relaxation and the muscle is then incapable of performing its useful function.

The original muscle torpor is valuable in that it permits the influx of the capillaries of the granulation tissue and the deposition of lime salts. Then the return of the muscle hyperirritability permits the laying down of useful callus. As an example of this, it will be noted that the so-called march fractures, which occur in areas which are not covered with muscles, heal poorly with much callus and pseudarthrosis. The best healing is obtained after accurate reposition of the fragments in areas where the muscles run parallel to the bone fragments.

WILLIAM C. BECK, M.D.

Experimental Degeneration of the Supraspinatus Tendon. CHARLES LAIRD WILSON. *J. Bone Surg.* 1948, 30-A: 769.

The pathology of rupture and degeneration of the supraspinatus tendon in human beings has been described in a previous publication. It has been shown that a characteristic type of degeneration precedes and leads to rupture of the tendon. There has been much speculation concerning the cause of this syndrome. The purpose of this article is to describe the experimental production of these pathological changes in the supraspinatus tendons of rabbits.

The supraspinatus tendon was traumatized in 46 rabbit shoulders. These tendons were examined at intervals varying from 42 to 111 days. When the shoulders were re-opened for biopsy, only 5 of the subdeltoid bursae had a normal appearance; 19 showed fine adhesions; 17 showed dense adhesions; and 5 were completely obliterated.

Some of the evidence of tendon degeneration observed in either partially or completely ruptured human supraspinatus tendons was reproduced in the supraspinatus tendons of rabbits by a single trauma. The microscopic evidence of tendon degeneration was a loss of the normal wavy configuration of the collagen bundles, the homogeneous appearance of the tendon, a change in the character of the staining properties, an increase in the number of blood vessels observed, and the loose, edematous, fibrillated appearance of the degenerated tendons. This fibrillation was not so marked as that observed in human tendons which had ruptured.

Of the 46 tendons, 87 per cent showed a loss of the normal wavy configuration of the collagen bundles and, instead, had a homogeneous appearance; 39 per cent showed early fibrillation; and 48 per cent showed an increase in the number of blood vessels supplying the tendon.

It is concluded that the degeneration observed in the human supraspinatus tendon is caused by trauma incurred during the life of an individual.

RUDOLPH S. REICH, M.D.

The Surgical Concept and Treatment of Supraspinatus Tendinitis (Concepto y tratamiento quirúrgico de la tendinitis del supraespinoso). RAFAEL DE VEGA Y FERNANDO DE ANDRÉS. *Rev. espan. cir.*, 1947, 7: 109.

The pathologic anatomy of supraspinatus tendinitis is divided into primary tendinitis, or that in which the degeneration changes are ultramicroscopic but in which necrosis of the soft parts is present, and the local metabolism and biochemistry are altered. However, there is no calcification; but if the condition is not arrested, calcification will invariably occur. The second type is calcified tendinitis in which the degeneration has progressed and deposits of one or more calcareous bodies are observed—the latter may occur in as high as 5 per cent of the cases.

Pain and loss of function are the predominant symptoms, which together with roentgen views of the shoulder reveal the diagnosis.

The medical aspects of therapy are similar to those of all rheumatoid dyscrasias. Special knowledge of the surgical anatomy and mechanics of the shoulder joint, however, is needed for the proper surgical handling of supraspinatus tendinitis. Operation is directed at restoring the dimension of the acromiohumeral space, the elimination of deposits, and the return of the full range of articular motion. To accomplish this, resection of the acromion process may be required, and the technique for its extirpation is given in detail. A modified Watson-Jones procedure is employed by the authors.

STEPHEN A. ZIEMAN, M.D.

Discussion of Physiopathology of the Paw in Volkmann's Disease. Experimental Study of Contracture Provoked by the Intra-Arterial Injection of an Organic Iodine Product (Réflexions sur la physiopathologie de la griffe dans la maladie de Volkmann. Etude expérimentale des contractures provoquées par l'injection intra-artérielle d'un produit iodo-organique). R. FONTAINE, CH. KAYSER, CH. MARX, and A. DANY. *Lyon chir.*, 1948, 43: 409.

While the etiology of Volkmann's contracture is now definitely known, being the result of an arterial lesion, the mechanism of the condition still remains obscure. The fact that ligation of the brachial artery is usually well tolerated minimizes the importance of ischemia. Some writers expressed the opinion that a

reflex originating at the point of injury provokes a spasm of arterioles in the muscles and a dilatation of the capillaries and venules. The resulting peripheral stasis leads to necrosis of the muscle tissue. This hypothesis obviously attributes the main rôle to trauma of the blood vessels, similar to the first mentioned theory. The third theory maintains that trauma of the nerves, either direct by osseous fragments, or by insufficient blood supply and cicatricial tissues, is of paramount importance.

There is no doubt that a relatively slowly developing contracture is attributable to an injury of the blood vessels, but a rapid development of Volkmann's syndrome is more difficult to explain.

An accidental injection of an organic iodine product into the brachial artery, which produced at once an arterial spasm and concurrently also a Volkmann's contracture, suggested to the authors the following experiments. A few cubic centimeters of an iodine product called "tenebryl" and used for intravenous pyelography were injected into the brachial arteries of dogs. A marked contracture developed after 3 to 10 seconds and was accompanied by severe pain and lack of the peripheral pulse. The contractures were registered by means of electromyography. They immediately reached the maximum height and decreased progressively within from 14 to 30 minutes. Direct compression of the brachial artery did not produce a contracture; however, immediately following the removal of the tourniquet, as soon as the injected product could reach the periphery, a contracture occurred.

After the section of all the nerve trunks, the first intra-arterial injection of tenebryl produced a contracture of a short duration, but a second injection had no effect.

A passive extension of the paw during the decline of the contracture provoked by an injection of tenebryl caused an instantaneous intensification of the contracture.

The following conclusions are drawn by the authors from their experiments. Contractures produced by injections of the iodine product depend on a certain mechanism in the central nervous system, as shown by the fact that the section of the peripheral nerves reduces greatly the intensity of the spasm and renders the repetition of the phenomenon impossible. The observation that a passive extension of the paw during the decreasing phase of the contracture intensifies the latter, explains some bad results of the treatment of Volkmann's disease by early extension of the flexed fingers.

JOSEPH K. NARAT, M.D.

Voluminous Myeloplaxic Tumors of the Tendon Sheaths of the Ankle with Secondary Osseous Lesions (Volumineuses tumeurs à myéloplaxes des gaines tendineuses du cou-de-pied avec lésions osseuses secondaires). F. CABY. *Mém. Acad. chir.*, Par., 1948, 74: 549.

A young woman consulted the author because of a deformity and pain in the left lower extremity of 10 years' duration. Nine years prior to the examination a fusiform shadow in the roentgenogram was found between the tibia, os calcis, and the Achilles tendon. Gradually the tumors increased in size and in 1942 osseous alterations were detected in the form of erosions in both malleoli, the scaphoid, astragalus, and os calcis of the involved extremity.

The examination revealed numerous round tumors surrounding the involved ankle. The foot was kept in an equinus position. The tumors, of soft consistency, were immobile, but not adherent to the skin. There were no adenopathies.

An amputation was performed through the lower third of the lower leg. The patient made an uneventful recovery.

The histologic examination revealed myeloplaxic tumors of pseudoxanthomatous character. The tumors were attached to the periarticular tissues and their vascularization appeared to be of an osseous origin. Apparently the tumors developed not from the synovia of the tendons but from osteofibrous sheaths.

JOSEPH K. NARAT, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Phlebography in the Localization of Incompetent Communicating Veins in Patients with Varicose Veins. THEODORE B. MASSELL AND JEROME ETTINGER. *Ann. Surg.*, 1948, 127: 1217.

The late results of varicose vein treatment by high saphenous vein ligation are unsatisfactory because of the presence of incompetent communicating veins not detected by tourniquet examination. A phlebographic technique for detection of incompetent perforators is described whereby three tourniquets are placed, respectively, just above the malleoli, just above the femoral condyles, and as high as possible on the thigh. Diodrast is injected into a superficial vein on the dorsum of the foot and films are taken. The tourniquet above the malleoli blocks the superficial venous channels and forces the injected material into the deep veins. If the deep channels are free of obstruction, the diodrast does not return to the superficial veins. The two tourniquets on the thigh, however, provide enough obstruction to the normal flow to cause the diodrast to pass retrogradely through incompetent perforators to the superficial system.

Twenty cases are described in which preoperative localization by tourniquet tests and phlebograms was carried out and operation was then done to verify or disprove the preoperative data and test the comparative accuracy of the two methods. Neither the tourniquet examination nor phlebography correlates completely with the operative findings. Fifty-four per cent of the incompetent veins localized by tourniquet were confirmed by surgery whereas 86 per cent localized by phlebography were confirmed. Also, incompetent veins not detected by tourniquet or phlebography were found at operation, which made the over-all localization accuracy of tourniquet tests 29 per cent and that of phlebography, 69 per cent.

Actually, the operative findings are not always completely accurate. The anterior tibial veins appear to be the most difficult to be visualized roentgenologically, and at times the posterior tibial veins are not completely filled. Visualization of the peroneal veins is almost always excellent. Improvements in roentgen-ray technique and experience in interpretation will probably increase the accuracy of phlebography in localizing incompetent communicating veins. JESSE E. THOMPSON, M.D.

Wounds of Common Carotid Arteries. Report of 17 Cases from World War II. KNOWLES B. LAWRENCE, LAWRENCE M. SHEFTS, and JOHN R. MCDANIEL. *Am. J. Surg.*, 1948, 76: 29.

A series of 17 wounds involving the common carotid artery occurring during World War II is reported. Excluding 1 case, the average recorded time lag from wounding to surgery was 11.6 hours. The artery was ligated in 12 instances with the survival of 8 patients and transient hemiplegia in 2. Of the 5 patients in whom ligation was not done, 4 died; 2 from arterial occlusion by a thrombus, 1 because of a coincident hemorrhage from a severed vertebral artery, and 1 following arterial anastomosis by the Blakemore method.

Early wound débridement and direct attack on the arterial defect was preferred in these injuries of the common carotid artery. Immediate ligation is highly hazardous. The extent and spread of the thrombus in the arterial tree and the quality of the pre-existing collateral circulation are the two most important factors in the eventual prognosis, and both are unpredictable clinically. The mortality rate in this series was 47 per cent.

Recent improvements in surgical methods for restoring blood vessel continuity, notably by rapid temporary canalization, may reduce the mortality rate, and should be employed whenever possible. However, the unavoidable time lag before surgery and the inherent inadequacies of the cerebral collateral circulation shown by many individuals will probably maintain the mortality rate at a high level. ROBERT A. NABATOFF, M.D.

Experimental Studies in Vascular Repair. Comparison of Reliability of Various Methods of End-to-End Arterial Sutures. HARRIS B. SHUMACKER, JR., and ROBERT I. LOWENBERG. *Surgery*, 1948, 24: 79.

Since the relative worth of various techniques can be determined by controlled experiments performed upon one artery on one species of animal by the same group of workers, the authors, using the common carotid arteries of dogs, compared the reliability of four types of end-to-end repair: interrupted plain, continuous plain, continuous mattress, and interrupted everting mattress sutures. Neither techniques involving nonpenetration of the intima nor nonsuture methods were studied. Anticoagulants were not administered.

From these studies it appeared that mattress sutures which fix the opposed ends of the vessel in a position of eversion are superior to plain sutures which bring the ends of the vessel together layer to layer. The superiority of the mattress technique is most evident with regard to the avoidance of such complications as dehiscence, aneurysm, and stricture; there was no significant difference between plain or mattress sutures with regard to the incidence of thrombosis. Also, less bleeding was noted when mattress sutures were used. It also was apparent, although the series was too small for significant analysis, that the chance of success in arterial suture is definitely reduced when one is working with a vessel of extremely small size. No significant difference was

noted between the use of continuous and interrupted suture methods.

Regardless of the method of suture, certain fundamental principles must be followed to obtain good results:

1. The loose external adventitia must be stripped so that adventitia does not fall into the suture line.
2. The vessel must be handled gently.
3. The vessel must not be allowed to become dry.
4. Only fine needles and fine nonabsorbable suture materials should be employed and these should be kept moistened with mineral oil or saline solution.
5. The vessel wall should be approximated with the intimal layer everted.
6. Infection must be avoided.

EDWARD H. CAMP, M.D.

Experimental Portacaval Anastomosis. RICHARD E. GARDNER, FRANK H. LEEDS, and NORMAN E. FREEMAN. *California M.*, 1948, 69: 1.

The authors performed an anastomosis of the end of the portal vein to the side of the inferior vena cava in 15 dogs. The operative exposure was modified in the last 9 cases to a right thoracoabdominal incision which extended along the tenth interspace and divided the diaphragm laterally and posteriorly to the attachment of the liver. The hepatorenal ligament was cut and the kidney pushed down. The anterolateral surface of the inferior vena cava was dissected free from the entrance of the renal vein to the point where it passed beneath the liver. Dissection of the portal vein from the superior mesenteric vein to its bifurcation at the hilus of the liver was then done. The vena cava was then partially occluded by a modified kidney pedicle clamp and incised longitudinally on its anterolateral aspect for anastomosis to the divided portal vein. Deknatel ooooo and a curved atraumatic needle were used to place everting mattress sutures at each end and the anastomosis was completed with a continuous anterior posterior suture, tied to the everting mattress sutures. The animals were sacrificed at intervals of from 1 day to 4 months postoperatively. There was thrombosis in one instance which they ascribed to some angulation of the portal vein.

This method was used in one patient with portal cirrhosis, in whom the approach was modified by entering the ninth instead of the tenth interspace. The patient expired on the fifth postoperative day from hepatorenal failure. At autopsy the anastomosis was patent. The use of a left thoracoabdominal approach for splenorenal anastomosis in clinically doubtful cases is suggested.

LEROY J. KLEINSASSER, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Further Studies on the Anticoagulants. CARL REICH AND WILLIAM EISENMENGER. *Am. J. M. Sc.*, 1948, 215: 617.

This report embodies a continuation of studies on dicumarol and heparin initiated at Lenox Hill Hospital, New York, New York in 1943. Since that time these anticoagulants have been under constant observation at this institution. They have been used both for the prevention and the treatment of thrombotic conditions. Favorable results have been described in previous communications.

The present series of cases including approximately 300 patients can be divided into 4 main groups: (1) postoperative cases in which treatment was given prophylactically with anticoagulants to prevent thrombotic conditions; (2) cases of active venous thrombosis; (3) acute embolic episodes, usually pulmonary; and (4) cases of coronary thrombosis.

Postoperative venous thrombosis and pulmonary embolism can definitely be prevented in all cases by the prophylactic use of anticoagulants.

The treatment of established thrombotic conditions by means of anticoagulants is effective and safe.

In coronary artery disease the main value of the anticoagulants is the prevention of complicating embolism.

The details of the use of heparin and dicumarol are outlined in full. The authors' wide experience is also given in detail. HARRY W. FINK, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

The Control of Infection in Burns. LEONARD COLEBROOK, J. M. DUNCAN, AND W. P. DALLAS ROSS. *Lancet*, Lond., 1948, 1: 893.

This is the second report on the control of infection in burns at the Birmingham Accident Hospital in England. Since 1945 a serious attempt has been made to treat burns under conditions which aim at eliminating not only infections from "contact" (hands, instruments), but also airborne infections.

The term "infection" is used throughout in a bacteriological rather than a clinical sense. The term "added infection" connotes the recovery of one of the three "indicator organisms," that is, hemolytic Streptococcus (Group A), Pseudomonas pyocyanea, or Bacillus proteus, if these organisms were not found on any of the patient's burned areas on admission. It is the equivalent of "acquired in the hospital."

The method of treatment of the burned surfaces was essentially the same throughout the three year period. Briefly, the wounds were cleansed and penicillin cream was applied. Great care was taken to obtain perfect coverage of the burns, and skin replacement was carried out for the deeply burned areas at an early stage. Penicillin and the sulfonamides were seldom given systemically. Dressings were applied by a team using strict aseptic precautions. All dressings but the first were applied in a special room continuously supplied with an abundant stream of twice filtered and warmed air which escaped by a single exit. An interval of 5 minutes was allowed between dressings for re-cleaning the air. Cultures were taken on admission and at each subsequent dressing.

The outstanding feature of this experience was that it has been possible to eliminate almost completely clinically manifest infections from the Bacillus hemolytic streptococcus (Group A) and to reduce the "silent" infections to very few. Only 3.9 per cent (29) of the patients already had an infection from this bacterium on admission, but none were seriously ill. The streptococci were eliminated within a few days by the local application of penicillin cream at 2-day intervals. Thirty-eight, or 5.4 per cent, of the patients acquired an infection of this kind during their hospital stay, but in no instance was there an infection of the invasive type. In only 14 patients did the Streptococcus appear within the first 2 weeks. On the few occasions when streptococci were present on a wound at the time of skin grafting the "take" was poor or nil.

Only 1.8 per cent (13) of the patients had Pseudomonas pyocyanea on admission, and none of these was admitted early after the burn. However, 8 per cent (60) acquired the organism in the hospital. In all but 3 cases transmission of the infection took place in the wards between dressings and there was a close correlation between these added infections and imperfect covering of the wounds. There is much to be learned about the spread of this infection. This organism has never been cultured from the throat or nose swabs of either staff or patients. It appears that the dissemination is by dust and probably flies. However, as Neal Owens has pointed out, the imperfectly applied burn dressing may become soaked with serous fluid and be transformed into a mass of culture medium through which pathogens conveyed to the outer bandages will readily grow and infect the underlying wound. A sheet of cellophane incorporated in the dressing serves as an effective barrier.

The usual local applications of substances reputed to be efficacious against these organisms have failed. The Pseudomonas pyocanea readily acquires a resistance to streptomycin in the form of a cream. Fortunately, not much harm has resulted from the infections, and skin grafting and healing of the wounds has been little affected. However, there were 3 cases in which the results were almost disastrous and which reaffirm the urgent need for a therapeutic agent which will eliminate pyocyanea infection from burns as rapidly as penicillin does in the case of the hemolytic Streptococcus.

Only 0.8 per cent (6) of the patients had Bacillus proteus on their burns on admission, while 12 per cent (89) acquired it during their hospitalization. All attempts to eliminate this organism by local application have failed but the organism disappeared as the burns healed.

The Staphylococcus has been the most frequent invader of the burns. Only 3 per cent of the patients had this organism on admission but in the more severe cases from 60 to 70 per cent of the patients acquired it at some period of their stay in the hospital. The source of this infection is not clear. In 20 per cent of the patients the organism was recovered from nasal swabs, and during the hospital stay this percentage increased to about 50 per cent. The presence of the Staphylococcus in the early stages was associated with slight suppuration and with little or no fever. In a few cases, but not always, the presence of staphylococci on a burn interfered with the successful "take" of skin grafts. The Staphylococcus quickly becomes resistant to local penicillin and especially to local cream applications of penicillin and sulfathiazole.

Infection from Bacillus tetani has not occurred in any case and therefore no antitetanic serum has been given.

The great majority of burns which became infected at some period of hospitalization had no pathogens on admission; therefore, most of the infections were acquired in the hospital. At least 90 per cent of the infections were due to transmission, not at the time of dressing in the specially designed dressing rooms but between one dressing and the next. The transmission took place in the wards and it was clearly associated with imperfect coverage of the wound in most of the cases.

In a few cases serological identity of the streptococcus proved it to have been derived from the patient's own skin or respiratory tract. In the great majority of cases there was no such autogenous origin and the transmission of pathogens occurred by indirect contact from another infected case or by airborne particles.

This study has made it clear that the majority of these injuries can be kept free from any infection that is clinically significant if the proper conditions are provided. Such provision will involve considerable effort and expense. The questions arise: how much does infection really matter? and, is all this effort and expense justified?

The clinical picture of the infected severe burn is all too familiar to most surgeons. The antibiotics have improved this picture to some extent, yet the factor of sepsis remains substantially true for most severe burns. Certainly the clinical course of the severely burned patient who does not become infected presents a striking contrast. Such a great change in the clinical course is reflected in the mortality and the period of incapacity.

It is estimated that there are nearly 25,000 burned patients admitted to hospital beds each year in England and Wales. On the assumption that if they become infected they occupy these beds 10 days longer than uninfected patients it would mean a saving of 250,000 hospital-bed days each year. The saving of life and pain, the recovery of full function, and the economy of man power and hospital facilities add up to the conclusion that the avoidance of infection in burned patients is the central problem after the management of the shock period.

If that conclusion is valid it means a complete reorientation of our thinking and teaching about burns—we must definitely take as our target the complete elimination of septic infection just as we do for operative surgery. Such a program requires a four-fold attack:

1. No pathogens must be allowed to reach the wound at the time of dressing. This means the prevention of transmission from the respiratory tract, instruments, dressings, and the air of the room. The use of a specially ventilated room is desirable.

2. No pathogens must be allowed to reach the wounds between one dressing and another. This is a matter of greater difficulty and probably will always be so because burned patients are more easily infected and more infective than any other class of patient. It is far from simple to protect a burn with a proper dressing which offers an effective barrier to bacterial invasion. Even an intact dressing will not afford effective protection when it is soaked with serum for pathogens can grow through it from the outside. Aside from an effective dressing it has been clearly shown that single-bedded cubicles afford the best safeguard against cross infection.

3. The prompt elimination of pathogens from the wounds of those who do become infected is the next objective. By virtue of the power of the antibiotics to control streptococcal infections, these infections are now the easiest to control. If we knew how to eliminate the Pseudomonas pyocyanea and staphylococcal infections equally promptly, certainly the management of a ward full of burned patients would become much easier.

4. The number of raw surfaces must be reduced as much as possible by early and, if necessary, repeated skin grafting. Yet, however much we improve the set-up for burned patients by nursing in cubicles, dressing in microbe-free air, and the prompt elimination of pathogens, it will never be easy to keep a large raw surface free from infection. The opportunities for such infection will always be numerous and the danger is only past when the raw surface is covered with skin.

There remains for discussion the problem of the influence of administrative management on the control of infection in burned patients. Few hospitals make special provisions for these injuries and the system adopted heretofore of admitting them into general wards of all hospitals cannot be regarded as satisfactory. The treatment is left for the most part to an inexperienced house surgeon. Skin grafting is often not done or is postponed until all sloughs have separated (after 4 to 6 weeks) when the optimal conditions for a successful "take" no longer exist.

Such arrangements do not offer the burned patients the best or even a good chance of recovery without infection, or recovery with full function.

HARVEY S. ALLEN, M.D.

Numerous Tetanus Cases During the Last Phase of the War and Their Treatment with Anatoxin-Tetanus-Formol-Toxoid (Ueber gehaeufte Tetanuserkrankungen in der letzten Phase des Krieges und ueber die Behandlung des Tetanus mit Anatoxin-Tetanus-Formol-Toxoid). H. KUNTZEN. *Chirurg*, 1947, 17-18: 157.

While in Germany the opinion prevailed that a passive immunization against tetanus provides sufficient protection, other countries accepted the method of active immunization. The fact that the passive immunization lasts only from 12 to 14 days was sometimes overlooked in patients with several injuries sustained at short intervals and in such instances tetanus occasionally occurred.

Suddenly in 1944, during the battles in the northwest region of France, the frequent development of tetanus was noticed and in each instance the condition took a grave course. The geographic conditions, intensification of the virulence, peculiarity of the injuries, and the diminished activity of the prophylactic treatment were considered responsible factors.

The author calls attention to the fact that in Normandy it is customary to employ manure as fertilizer. He is inclined to believe that for unknown reasons the virulence of the tetanus bacilli increased. The kind of missiles was responsible for the increased destruction of tissues. Many wood splinters from collapsing houses were found in the wounds and they favored the tetanus infection. A check-up showed that no serum injected was older than 2 years.

The author calls attention to the fact that in all tetanus cases a prophylactic injection had been given, that the incubation period was long, and yet the course of the disease was very grave.

The author considers intravenous serum injections as dangerous, especially because an allergy created by previous serum administration may be expected in a large percentage of cases. He also considers doses larger than 50,000 units per day as excessive.

Many surgeons prefer avertin to other sedatives, but autopsies repeatedly show a fatty degeneration of parenchymatous organs attributable to that drug. Therefore, the author prefers the administration of different sedatives each day.

In view of the fact that none of the war prisoners in whom an active immunization had been employed developed tetanus, the author concludes that this method is superior to passive immunization. The danger of shock from serum is also eliminated when active immunization is employed.

JOSEPH K. NARAT, M.D.

Late Tetanus (Spaettetanus). HANNS-HEINZ FISCHER. *Chirurg*, 1947, 17-18: 651.

A 34 year old patient was operated on for peptic ulcer in January, 1946. Stomach resection and gastroenterostomy were performed and uneventful recovery took place. Five weeks after surgery, the day on which the patient was to be discharged, infarction was found in the left upper lobe of the lung, with elevated temperature and bloody sputum. Seven days after this episode, there were pains in the jaw and in the chest, and on the next day there was trismus and typical tetanus. Only at this time did the patient mention that he was wounded by a rifle shot in the left upper part of the chest in November, 1942. A fine scar in the left third intercostal space was present which had been overlooked before. The patient expired 2 days later, in spite of 100,000 units of antitoxin, given intravenously and intramuscularly. No autopsy was performed.

This case is typical for late tetanus. Spores deposited at the time of the first injury may survive for many years and be mobilized by subsequent injury, operation, or other trauma. The tetanus bacillus is anaerobic. Secondary infections with aerobic bacilli which absorb the oxygen in the tissues create optimal conditions for the development of the spores. In the present case, the spores were mobilized by a postoperative lung infarction, more than 3 years after the original injury. The extremely rapid course of the disease is characteristic for tetanus of the upper respiratory tract.

In connection with this case the author discusses the question of tetanus of other pathogenesis after abdominal surgery. Tetanus bacilli are found frequently as saprophytes in the stools of normal persons (between 5 and 40 per cent, according to different statistics). The possibility of tetanus infection in operations in which the field is exposed to contamination by fecal matter cannot be ruled out entirely, and some authors advise preoperative prophylactic antitoxin in such cases.

WERNER M. SOLMITZ, M.D.

Present Day Tendencies in the Treatment of Gas Gangrene (Indirizzi odierni nella cura della gangrena gassosa). LEONARDO GUI. *Chir. org. movim.*, 1948, 32: 167.

In 34 of 45 cases of gas gangrene, amputation proved necessary. There were 26 amputations of the thigh, 5 of the leg, and 3 of the arm. There were two exarticulations of the hip joint. In the remaining 9 patients the treatment was limited to local exposure of the wound trajectories with thorough débridement. The wound edges were either cut down to form a broad depression for the wound, or turned back to form a flat surface and no suturing was done. In 4 of these 9 cases demolition procedures could not be instituted because of the location of the wound. In 1 instance the wound was situated in the scapular region and in 3, in the region of the buttocks. In the remaining 5 patients local treatment was judged sufficient because of the localized character of the gangrenous process and because it showed little tendency to spread. In 3 of these 5 instances the wound was in the region of the foot, and in 2, in the region of the leg. Eventually one of these patients with

involvement of the foot had to undergo a leg amputation, and 1 with a leg wound had to have an amputation at the thigh.

The total mortality in these 45 cases was 15 (30 per cent). This figure compares favorably with those of World War I, but is not as good as those of the allied armies of World War II. The latter, however, had the benefit of penicillin. Despite the fact that the sulfonamides show considerable activity against the organisms which cause gas gangrene, infections treated with these drugs seemed to be just as serious as those treated before the sulfonamides were available. This is true particularly of the oral administration of these drugs. However, when used locally in combination with the local and general application of penicillin the association does not seem to be antagonistic and may perhaps be synergistic.

Much may be expected of penicillin, not only in the matter of prophylaxis, but also in the control of the infection itself. In 2 of the author's patients the use of penicillin enabled the amputation, which was adjudged necessary, not because of the infective process but because of the circulatory conditions present, to be done through tissues which must be assumed to have been infected, and thus a useful stump was procured. This certainly could not be attempted before the advent of penicillin.

Of course, penicillin, or any combination of penicillin, the sulfonamides, and anti-gas-gangrene serum, cannot substitute for delay in getting these war wounds under treatment, or for the absence of an adequate force of properly trained surgical personnel. The wound must be adequately exposed, foreign bodies must be removed, and the wound must be watched for the earliest signs of gas bacillus infection.

In conclusion, the author warns that, although gas gangerene is characteristically a complication of fresh wounds, it may develop at re-intervention months or even years after the original injury, as happened in 2 of the author's cases. This eventuality is particularly apt to be met with in the cases of healed open fractures. JOHN W. BRENNAN, M.D.

ANESTHESIA

The Anesthetic Management of Patients with Fracture of the Mandible. S. G. HERSHEY and E. A. ROVENSTINE. *Anesthesiology*, 1948, 9: 381.

This is a report of the evolution of an anesthetic technique for operations specifically limited to the fractured mandible without serious involvement of the soft tissues. While the surgical results are not included here, they have steadily improved and permitted the oral surgeons to plan a definite approach to a difficult problem. There were no deaths and no serious sequelae relative to respiratory obstruction and aspiration.

Two precautions merit particular mention. Delirium after anesthesia can quickly defeat the entire purpose of the operation by disrupting the reduction and fixation of the fracture. For several years it has been observed that subemetic doses of apomorphine are almost invariably effective in overcoming this complication. The other precaution applies to those instances in which the jaws are to be wired to each other. Aspiration and suffocation resulting from postoperative vomiting are real hazards. It is routine practice to maintain the jaws fixed to each other with rubber bands instead of wire for a sufficient period of time postoperatively so that this accident may be avoided should vomiting occur.

The observations peculiar to the chronic alcoholic patient have been noted as have other lesions of significant value. Of most benefit has been the attitude that the method was still tentative and in need of revision. This produced a variety of solutions for each aspect of the problem and helped to create a technical versatility in managing the individual patient. MARY FRANCES POE, M.D.

SURGICAL INSTRUMENTS AND APPARATUS

A New Material for Surgical Sutures and Ligatures-Igamid B (Ein neuartiges chirurgisches Naeh- und Unterbindungsmaterial-Igamid B). L. SIMON. *Chirurg*, 1947, 17-18: 673.

The materials mostly used for surgical sutures, catgut, silk, and linen, present a number of disadvantages. Catgut is usually sterilized in formalin or tincture of iodine. However, only the surface can be sterilized with certainty by these procedures, and spores or cocci may survive in the interior of the thread, especially if larger sizes are used. This fact accounts for the occurrence of late infections and suppurations when the catgut is in the process of resorption and the interior layers are exposed.

Silk and linen can be sterilized more safely by boiling in 1 per cent mercuric chloride solution; however, frequent boiling decreases the resistance against tearing.

During the war, I. G. Farben in Germany developed a synthetic substance, called "igamid B," which proved to be very useful for surgical suturing. Chemically it is closely related to nylon. As it is manufactured at a temperature of 300°C. it is absolutely sterile. Its further advantages are that its resistance against tearing is extremely high, about the same as steel, so that much thinner threads can be used than with catgut or silk. Threads of any diameter can be produced. It does not swell by imbibing tissue moisture. It can be stretched about 15 to 20 per cent and is completely elastic. It can be sterilized by boiling any number of times without losing its original physical properties. It does not cause any local irritation.

The only disadvantage seems to be that the surface is very hard and smooth. This necessitates a special technique in tying knots to prevent slipping. Experiments with braided threads are under way to overcome this difficulty.

Also other surgical instruments have been made from this material: sheets to close defects in the abdominal wall in large abdominal hernias, bone hammers, bone nails, and wires.

WERNER M. SOLMITZ, M.D.

Supramid, a New Synthetic Substance in Surgery
(Supramid—ein neuer Kunststoff in der Chirurgie).
F. LINDER and M. SCHWAIGER. *Chirurg*, 1947, 17-18: 675.

Supramid is identical with igamid B which has been described by L. Simon. This article confirms the facts reported by Simon. Chemically, supramid is a so-called superpolyamid and it is closely related to nylon. Its physical properties are:

Specific weight 1.13

Resistance against bending, kgm./sq.cm. from 200 to 400

Resistance against tear, kgm./sq.cm. 500

Melting point, Centigrade, between 210 and 215

Heat resistance, Vicat centigrade, between 160 and 180

Heat conductivity, 10^5 cal./cm.sec. Centigrade, from 50 to 60

Imbibition with water in weight, per cent, 12.

It is resistant against boiling and steam sterilization. It can be produced in any desired shape. Thin threads of 0.15 mm. in diameter are available, as well as ribbons for the covering of bone defects in the skull or orthopedic protheses. It can be welded, drilled, sawed, and polished. It is, however, not hard enough to replace steel in bone nails. It is not resorbed in the body but, in contradistinction to other materials, it does not cause any foreign body reaction in the tissues. It is much more solid and resistant against bending and traction than silk or catgut.

Because of these properties, supramid is an ideal material for many purposes in surgery. In addition to its use for skin and muscle sutures and ligatures, it has been successfully used in suturing and replacing tendons, suturing spiral fractures of the tibia and humerus, transplanting bone, covering traumatic defects of the dura, and in plastic operations for saddle nose.

WERNER M. SOLMITZ, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Obstructions of the Alimentary Tract in Infancy. WILLIAM A. EVANS, JR. *Radiology*, 1948, 51: 23.

With the increasing success in the treatment of the infectious diseases of infancy and childhood by the use of the various antibiotics and chemotherapeutic agents as well as the adequate meeting of the nutritional requirements in infancy, the importance of congenital malformations assumes increasing stature. The advancing knowledge of surgical techniques and more accurate methods of diagnosis make a number of previously hopeless congenital lesions of the alimentary tract amenable to some degree of correction.

The author reviews the more common obstructing or potentially obstructing lesions of the alimentary tract in 400 infants seen at the Children's Hospital of Michigan, Detroit, in the past 7 years. While 50 per cent of the lesions seen were diagnosed as hypertrophic pyloric stenosis, only 19 per cent of these were subjected to radiological examination. The age of greatest incidence in this group of infants was 6 weeks.

Twenty per cent of the lesions seen were due to intussusception and only 30 per cent of these were subjected to radiological examination. The age of greatest incidence in this group was 5 months. Atresias, meconium ileus, constricting bands, and volvulus comprised only 22 per cent of the lesions, but this was the group that received most of the roentgen examination.

A brief clinical and radiological review of the pertinent points in the diagnosis of each of the lesions is given. Mention is made of functional obstructions of the alimentary tract resulting from intracranial birth injuries, as well as congenital absence of nerve cells in the lower ileum or colon. Diaphragmatic hernia is mentioned as an occasional cause of obstruction in the very young.

ROY GREENING, M.D.

The Roentgen Appearance of the Chest in Diseases Affecting the Peripheral Vascular System of the Lungs. Conditions Associated with Increased Vascular Permeability. ROBERT P. BARDEN AND DAVID A. COOPER. *Radiology*, 1948, 51: 44.

This article considers the roentgen appearance of the chest in certain clinical states associated with increased permeability of the pulmonary vascular system. A table listing many of the disease conditions affecting these blood vessels in this way is included. By means of a chest roentgeongram the changes produced by the altered permeability of the pulmonary vessels can be visualized, and this reflects the condition of the peripheral vascular system in general. Reproductions of roentgenograms illustrating these changes accompany a discussion of the following clinical conditions in which alterations in the permeability of the pulmonary vascular bed occur: trauma to the chest, epidemic influenza, disseminated lupus erythematosus, acute rheumatic fever, exfoliative dermatitis, acute glomerulonephritis, periarteritis nodosa, and Loeffler's syndrome.

The authors point out that these diseases all present a rather uniform pathological, clinical, and radiological pattern that results from the changes produced in the peripheral vascular system by hypersensitive states. Indeed, it is the hypersensitive reaction in the individual patient, which may be caused by a multiplicity of disease agents, that is the common denominator. The pulmonary vessels participate in this reaction and produce a fairly characteristic roentgen appearance of a bilateral, symmetrical, patchy to uniform haziness, usually in the upper portions of the lung fields either peripherally or in a perihilar location. These infiltrations are transient and change rapidly, making serial examinations necessary in order to ascertain that they are characteristic of peripheral pulmonary vascular disease. The radiologist, by being cognizant of this type of reaction in the vascular system of the lungs, can more effectively aid the clinician in arriving at a diagnosis.

D. B. NAGLE, M.D.

Some Considerations of the Roentgen Diagnosis of Silicosis and the Conditions that may Simulate It. EUGENE P. PENDERGRASS AND AGRIPPA G. ROBERT. *Radiology*, 1948, 50: 725.

The authors emphasize the fact that a fluoroscopic and roentgenographic examination of the chest constitutes the best method for demonstrating in the living individual the pathologic changes produced by pneumoconiosis or silicosis. It is necessary, however, to correlate the roentgen findings with all other available data before a proper diagnosis can be made. An ideal, although somewhat too ambitious, arrangement would be to have a group of consultants consisting of a general physician, a rhinologist, a bronchologist, a clinical pathologist, a specialist in tuberculosis, a physiologist interested in the heart and lungs, an engineer (expert in industrial hygiene), and a general roentgenologist.

"Pneumoconiosis" is a broad generic term which includes all forms of pulmonary reaction due to dust lodging within the lungs. A subdivision into the specific (silicosis and asbestosis) and nonspecific or benign pneumoconiosis has certain practical advantages. The former may be productive of disability, whereas the latter is of clinical significance only because it may lead to error in diagnosis.

The common features of silicosis and asbestosis are that they result from inhalation of the dust, are capable of producing a progressive pulmonary fibrosis, and lead to characteristic though radically different roentgen images.

The silicosis is due to the specific action of the chemically free silicon dioxide in finely divided form on the lung tissue. The inhaled dust first exerts its toxic influence within the bodies of the alveolar phagocytes. Degenerative changes, easily confused with those in the "epitheloid" cells of tuberculosis, quickly become evident. Lipoid deposition and giant-cell formation constitute part of the picture. The migrating phagocytes eventually concentrate the silica in and about the pulmonary lymphatics, stimulating consecutive tissue proliferation and resulting in the formation of the silicotic nodules situated in the immediate vicinity of the lymphatic vessels. The alveolar phagocytes will collect upon the walls of the air spaces proper and lead to the formation of parenchymal silicotic nodules.

Some inert dusts, as for example aluminum, when mixed with free silica may cause a retardation in the development of the silicotic process.

On the other hand, silicosis increases the susceptibility to tuberculosis. Two facts must be stressed; (1) that it is the pressure of associated infection which accounts for most of the disability arising from silicosis, and (2) that infection, when it occurs, may manifest itself in either of two ways, namely by the development of tuberculosilicosis or of silicosis with tuberculosis, the latter being the less frequent.

The criteria for diagnosis of silicosis include: a positive history of sufficient exposure to free silica dust, the roentgen demonstration of characteristic shadows, and various physical and laboratory findings which exclude other conditions.

The roentgen manifestations of simple silicons and of silicosis complicated by the presence of coexisting infection are detailed. The demonstration of a generalized nodulation, uniformly distributed throughout the pulmonary parenchyma, is of fundamental importance in simple silicosis. A subdivision into the three stages, in the development of which Gardner and Sampson had a prominent role, may have some practical value, but according to the authors it is the nature of the lesion that should invariably be emphasized rather than its stage of development.

The tuberculosilicosis is a distinct entity resulting from prolonged interaction of the two disease processes, but differing radically in its behavior from either occurring alone. Therefore, the roentgen manifestations may be quite variable and necessitate repeated careful studies.

Silicons with tuberculosis occur in one of two forms; either (1) as the result of infection superimposed upon a progressive and still active silicosis, or (2) as the result of infection superimposed upon an old and already stabilized silicotic process. In both groups the infection component is first identified on the roentgenograms by simple or multiple areas of infiltration or mottling superimposed upon a background of discrete nodulation. The subsequent behavior, however, may lead to roentgen images rather difficult of interpretation.

The criteria for the diagnosis of asbestosis are not reviewed in the present article.

Of the nonspecific pneumoconiosis, the authors briefly discuss baritosis, siderosis, the pseudonodulation due to inhalation of tin oxide, the talc pneumoconiosis, and the pneumoconiosis due to vanadium pentoxide.

Other confusing causes of nodular densities within the lungs are also discussed. These include: tuberculosis, histoplasmosis, mycotic infections, hemosiderosis, polycythemia vera, metastatic carcinoma, Boeck's sarcoid, and the chronic pulmonary granulomatosis in beryllium workers.

The article is abundantly illustrated with roentgenograms and a bibliography of numerous articles is appended. T. LEUCUTIA, M.D.

The Roentgen Diagnosis of Rickets Associated with Other Skeletal Diseases of Infants and Children. RALPH S. BROMER AND ROLFE M. HARVEY. *Radiology*, 1948, 51: 1.

The simultaneous occurrence of rickets with scurvy, congenital syphilis, lead poisoning, erythroblastic anemia, and osteogenesis imperfecta is discussed.

When rickets and scurvy occur simultaneously, the problem of recognition is difficult. However, the authors believe that the diagnosis can be made with a high percentage of accuracy in certain cases. In most of the combined cases the signs of scurvy obscure those of rickets unless the latter is severe.

The signs of identification of the combined diseases are:

1. Rarefaction of the cortex is of the rachitic motheaten type rather than the scorbutic ground-glass type.

2. In the enchondral metaphyseal area the signs of rickets predominate and may prevent the characteristic signs of scurvy.

3. In combined cases the osteoid zone of rickets can be diagnosed by a marked increase in the clear space between the epiphyseal center and the end of the diaphysis.

4. In the combined cases the ring sign about the epiphyseal center remains intact, which is indicative of scurvy.

5. Spreading of the diaphyseal ends cannot be considered indicative of either one or the other of the diseases. The distinction between the lateral spur of scurvy and the cupping of the diaphyseal ends of rickets can be made only by vertical projections through the zone of temporary calcification.

6. Periosteal triangular shadows of slight width compared to those usually seen in scurvy are indicative of scorbutic hemorrhage merged with rachitic periosteal elevation.

When rickets and syphilis coexist the only signs present are those of rickets. The periosteal involvement is so similar in the two conditions that differentiation is impossible.

In rickets with lead poisoning the characteristic lead line at the diaphyseal ends of the long bones fails to develop.

The authors quote the case of Caffey (*Am. J. Roentg.*, 1937, 37: 293) in which rickets was super-

imposed on erythroblastic anemia, but state only that the diagnosis of rickets could be made roentgenologically.

The case of osteogenesis imperfecta in which rickets and scurvy developed was reported previously by Bromer (*Am. J. Roentg.*, 1946, 55: 30). This case showed the signs of osteogenesis imperfecta and the usual signs of rickets, i.e., decalcification, flaring of the diaphyseal region of one radius, and an osteoid zone distal to the frayed out zone of preparatory calcification. Six months later the child had unmistakable signs of scurvy. JOHN O. LAFFERTY, M.D.

The Skeletal Lesions in Leukemia. FREDERIC N. SILVERMAN. *Am. J. Roentg.*, 1948, 59: 819.

The author reports the clinical and roentgenographic observations in 103 leukemic infants and children who were admitted to the Babies Hospital in New York during the period from 1924 to 1947. The ages at the onset of the symptoms varied from 22 days to 12 years and 7 months. More than 70 per cent of the patients died within 7 months after the clinical onset of their disease. Abnormal white blood cells were found in the peripheral circulation in 102 of the 103 cases. Forty patients had persistently high counts, that is, above 12,000 white blood cells per cubic millimeter, and 27 had persistently low counts, below 12,000. The presence of an increased erythrocyte sedimentation rate was a related finding in almost all of the cases. Fifty-two of the 103 leukemic children showed bone changes in their roentgenograms. Four types of lesions were found: transverse bands of diminished density, osteolysis, osteosclerosis, and subperiosteal new formation of bone.

Frequently, more than one type of lesion was present in a single patient. Forty-two patients complained of pain, 25 had skeletal lesions demonstrable in roentgenograms, and 17, presented no lesions. No significant correlation was observed between the sites of the pain and the sites of the lesions. Seventeen patients complained of pain but showed no lesions. Of the 52 patients with lesions, 25 had pain and 27 had no pain. Thirty-four of the 103 patients had no lesions and no skeletal pain. Transverse bands of diminished density occurred at the ends of the shafts of long bones in 14 patients. Osteolytic lesions occurred in 39 patients, osteosclerosis occurred in 9 patients, and subperiosteal new bone formation occurred in 17 patients.

Associated roentgen findings outside of the skeletal system which were often helpful in the diagnosis were enlargement of the lymph nodes, mediastinal tumors, and enlargement of the adenoids.

The diagnosis of leukemia in infants and children is often made difficult by factors which do not operate significantly in adults. Chief among these are the tendency of nonleukemic children to produce immature white blood cells in response to severe infections, and the frequent absence of leukocytosis in children with leukemia. The demonstration of leukemic changes in the bones by roentgen examination provides valuable information for the detection of leukemia during early life.

FRANK L. HUSSEY, M.D.

Studies of the Circulation by Roentgencinematography. NILS WESTERMARK. *Radiology*, 1948, 50: 791.

The author reviews the experimental work that had been carried out formerly by various methods for the study of the velocity and circulation time of the blood and their relationship to the cardiac contraction. He also discusses the earlier physiological attempts at recording the cardiac movements. In particular, the role of the movements of the atrioventricular junction for driving out the blood from the ventricle is stressed.

In a recent publication, the author described how roentgencinematographic and simultaneous electrocardiographic examinations were carried out on the hearts of sheep with metallic indicators implanted in the myocardium in different parts of the left ventricle. By this method some new observations were made on the expulsion of the blood from the ventricle.

Our knowledge of the dynamics of the heart is based mainly upon pressure curves taken simultaneously from different parts of the organ, and from the vessels. Lewis has established diagrams representing the curves of pressure in the carotid artery, aorta, left ventricle, and right auricle of the human being and demonstrated the supposed or ascertained the time relations of these curves, the jugular pulse curve, the electrocardiogram, and apical heart sounds to each other. The author reproduces Lewis' diagrams and discusses the various factors in lengthy detail.

He then proceeds to describe the technique of his own experimental study of cardiac contraction and its relationship to the blood circulation by means of indirect roentgencinematography of the contrast-filled circulatory system. The experiments were carried out in rabbits by injecting 20 gm. of thorotrast, corresponding to 1 or 1.4 per cent of the body weight of the animal, into the jugular vein. The circulation was recorded by cinematography of the fluorescent image produced by roentgen exposure. The timing of the various phases of the circulatory cycle was determined by means of electrocardiograms which were made simultaneously, a photo tube being used for the synchronization. The thorotrast was found to mix well with the blood and gave a homogeneous shadow. Altogether 50 experiments were made.

It was found that the rapid inflow of the blood into the ventricles occurs during the presystole and not at the beginning of the diastole as was formerly assumed. The expulsion of contrast blood from the ventricles would also seem to occur later than demonstrated by pressure determinations.

According to the experiments, the expulsion through the arterial ostia occurs at the beginning of T, and not immediately after S, as shown by pressure determinations. The closing of the atrioventric-

ular and semilunar valves takes place as observed formerly.

The author gives the following intepretation of these observations:

It seems probable that the systolic contraction of the ventricle begins with a contraction of the interventricular system, in which the septum is shortened and the central part of the atrioventricular junction is drawn toward the cardiac apex. When this contracts, the wall swells and the inner contour of the apex moves, together with the septum, toward the base, the retrograde movement of the atrioventricular junction taking place simultaneously. Then the contraction will continue along the external ventricular walls up toward the arterial ostia. This continuous systolic contraction starts with the commencement of the QRS-complex and finishes at the end of T, when the contrast blood has been almost completely expelled from the ventricles and the semilunar valves are closed. Systole once complete, the ventricles will not relax immediately. This might explain the fact that no filling of the ventricles is distinguishable until P, when rapid flow of contrast blood to the ventricle sets in. T. LEUCUTIA, M.D.

Roentgen Treatment for Extensive Epithelioma of the Larynx; Results in 139 Cases. ARTHUR U. DESJARDINS, FREDERICK A. FIGI, AND LUTHER M. VAUGHAN. *Am. J. Roentg.*, 1948, 60: 29.

The authors review and analyze a series of 139 cases in which epithelioma of the larynx had been treated with fractional doses of roentgen rays from 1936 through 1945. All the patients had extensive epithelioma and in most of them the neoplasms were so extensive that surgical treatment was not considered advisable.

In 56 of all the patients included in this series of 139, tracheotomy was not performed at any time. Tracheotomy was performed before roentgen treatment in 76 cases, during the course of roentgen treatment in only 1 case, and soon after the course of treatment in 6 cases.

All patients were treated with rays generated at 200 peak kilovolts, filtered through a Thoraeus filter consisting of 0.44 mm. of tin, 0.25 mm. of copper, and 1.0 mm. of aluminum, at a focal-skin distance of 50 cm. The half-value layer was equivalent to 1.75 mm. of copper. In most cases the treatment was given through two lateral fields (one on each side), each of which measured from 8 by 12 cm. to 12 by 18 cm.; but in a small number of cases the treatment was given through three fields (two on one side and one on the other). When two fields on one side were employed, they were on the side on which the bulk of the malignant process was situated.

Of the 139 patients in the entire series, 71 were treated between 1935 and 1942, inclusive, and of 3 of these the authors were unable to obtain recent information. This left 68 patients who were treated during this period and who were living more than 5 years since their treatment at the Mayo Clinic. As percentages of "cured cases" go, this proportion is not as high as might be expected but, considering the initially unfavorable character of these cases and the extensive malignant neoplasms from which the patients suffered, even this percentage seems worthy of consideration. There is no doubt that if these patients had not been treated in the manner described by the authors all of them must inevitably have died in short order. Moreover, the pronounced relief of symptoms and improvement in the general condition which, in the patients who died, had occurred after treatment cannot be estimated.

Roentgen Therapy of Malignant Tumors of the Testis. EUGENE T. LEDDY. *Am. J. Roentg.*, 1948, 60: 39.

Seminomas and malignant teratomas together constitute about 95 per cent of all malignant tumors of the testis. Seminomas are encountered about six times more frequently than malignant teratomas. Both of these tumors occur during the years of greatest sexual potency, but the maximal incidence of teratomas occurs earlier in life than does the maximal incidence of seminomas.

The author states that the adoption of Broders' classification would go a long way toward correcting the confusing and contradictory views about testicular tumors.

A distinction by the pathologist of seminoma from malignant teratoma gives the basic indications on which roentgen therapy may be planned. Orchectomy is advised both as a diagnostic and therapeutic procedure even in the presence of known metastatic lesions in all but very exceptional cases. After a brief period of postoperative convalescence it is the practice at the Mayo Clinic to administer a course of postoperative radiotherapy. Recently malignant teratomas have been exempted. Radium was used in the early days, but because roentgen therapy is, as a rule, more practical, more efficient, and more expedient than radium therapy, radium is now seldom used.

It was the author's opinion, at the time the report was written, that irradiation of seminomas of the testis and their secondary deposits could best be carried out with roentgen rays of moderate voltage (130 to 140 kv.). Prophylactic postoperative treatment, if it is to be truly protective against metastasis, should be applied to all lymphatic pathways through which metastasis may take place. This, obviously, makes extensive treatment necessary.

Some tumors may be a mixture of a seminoma and a teratoma. In this case, the initial response of the tumor may be satisfactory because the seminoma is destroyed; however, after the initial response has taken place, the residual tumor may not respond and the tumor may grow in spite of treatment. For the treatment of seminomas, roentgen therapy has assumed a position of prime importance and has altered the prognosis from one of hopelessness to one of subdued optimism.

Since the radiosensitivity and, therefore, the prognosis of seminomas are completely different

from the radiosensitivity and prognosis of malignant teratomas, accurate pathologic diagnosis as a basis for roentgen treatment is justified. The author describes a method of treatment which is said to be as effective as any reported and safer than many; it is based on extensive experience.

MISCELLANEOUS

Neutron Therapy and Specific Ionization. Janeway Memorial Lecture, 1947. ROBERT S. STONE. *Am. J. Roentg.*, 1948, 59: 771.

The author reviews the results of intensive treatment of human cancer between 1938 and 1943 with neutrons. Neutrons are particles of matter of the same weight as the nuclei of hydrogen atoms. They have no electrical charge. They are obtained by knocking them out of atomic nuclei by bombardment with high energy photons or atomic particles. The physical measurement of neutron radiation in air in units that can be translated to tissue doses comparable to tissue roentgens has been difficult. The N unit of exposure is physically equivalent to about 2.5 roentgens as judged by the amount of energy absorbed from a beam by tissue. In other words 1 N equals 2.5 rep (roentgen equivalent physical). The biological work on the Plutonium Project, and the work on human beings here reported show that the relative biological effectiveness of neutrons compared to roentgen rays is greater in the late results than in the early ones.

The method used at the University of California to obtain a beam of fast neutrons was by means of the cyclotron devised by E. O. Lawrence. From September 26, 1938 until June 20, 1939, a total of 24 patients were treated on the 37 inch cyclotron with 8 mev deuterons to produce the fast neutrons. Beginning in November, 1939 and up to February, 1943, the cyclotron with 60 inch pole faces which gave deuterons with 16 mev of energy was used. The total number of patients treated was 226. Thirty-one patients did not complete their courses of treatment. A few of the patients had only one treatment. One patient was treated on both cyclotrons and is included in both totals. On January 1, 1948, 17 of the patients were alive, and all but one, who lacked only 1 month, had lived more than 5 years from the day of his first treatment. All of the patients with one exception who were treated with fast neutrons were considered incurable. All kinds of malignant conditions were treated. Many of the patients had had previous treatment with other methods. Sixteen patients who received complete courses of treatment with fractionated doses of fast neutrons have been observed for more than 5 years. Thirteen of them had severe epidermolytic reactions in all treated areas; 1 had epidermolysis in one of the 3 fields; 1 had an erythematous reaction; and 1 had only desquamation. Most of them had severe early reactions. Eighteen patients were kept alive. They all had severe late reactions; 12 of them had such severe changes that they were partially incapacitated. The late tissue reactions consisted of marked skin atrophy, telangectasis, loss of subcutaneous fat, contractions of the scarred area, and fibrosis of the muscles. In lesions of the mouth, pharynx, and larynx there was persistent ulceration at the site of tumor regression. Some of the patients with lesions that were treated through the mandible developed radiation osteitis. When treatments were given through the pelvis, the effects on the intestine were quite severe.

From the study of the patients treated with neutrons it is clear that cancer cells can be killed and patients "cured" of their cancer, but the difference between the dose required to kill cencer and that to damage normal tissue acutely is very small. Eighteen patients were kept alive, but none of them were free from distressing late effects. Anyone contemplating the use of new radiations, such as multimillion volt protons, beta rays, and roentgen rays, on patients should study their late biological reactions as well as their acute early ones. FRANK L. HUSSEY, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Death from Inhibition, and Its Relation to Shock. A. I. KAYSSI. *Brit. M. J.*, 1948, 2: 131.

Among medicolegal experts there is apparent a certain confusion in describing the nature of death from inhibition, and often also in discussing the effects of shock and of inhibition. Death from inhibition covers all sorts of sudden death occurring within a few seconds, or not longer than 2 minutes, after trauma or peripheral excitation relatively simple and not in itself sufficient to cause death. No pathological changes which would be liable to account for death must be present at the subsequent autopsy. Medicolegal authorities are satisfied that this kind of death is explicable only on the basis of an "arrest" or "inhibition" theory, by excitation of some part of the vagus nerve. Some authors attach special importance to certain parts of the body, such as the laryngeal, epigastric, testicular, cervical, and cardiac regions, when these are subjected to trauma or irritation. Others classify the deaths according to whether they are frequent, rare, or exceptional in the regions involved; while still others suggest that death may take place irrespective of the area concerned.

Among more than 2,000 cases of sudden death, there were 2 which the author could not explain except by the mechanism of inhibition. It is his opinion that certain regions, as mentioned above, are of particular importance in this regard, and also that there must be a constitutional susceptibility which varies from individual to individual. A search of the literature did not reveal any cases worth serious consideration in which excessive emotion or psychic trauma was advanced as the cause of death from inhibition. Such cases are probably due to pre-existing heart disease, with emotion provoking a sudden hypertension. Death from inhibition is of infrequent occurrence but a definite entity. It is not to be confused with shock or syncope.

JOHN L. LINDQUIST, M.D.

Clinical Considerations of the Problem of Extrarenal Excretion; Peritoneal Lavage. HOWARD M. ODEL, DEWARD C. FERRIS, AND MARSCHELLE H. POWER. *Med. Clin. M. America*, 1948, 32: 989.

Acute renal failure and uremia occur fairly frequently in patients in whom irreversible renal changes cannot be demonstrated. In this group of patients the mortality rate, unfortunately, is high because of the rapid and marked accumulation in the body of nitrogenous and other waste products, which under ordinary circumstances would be excreted by the kidneys.

Many such patients might recover, if a means could be devised to eliminate toxic end products of the metabolism during the period of suppressed renal function. Such a means is available in the form of peritoneal lavage. The procedure itself is basically simple, and it should be possible to carry it out with successful results in a high percentage of cases. Yet, in patients in whom its use is indicated, one invariably is dealing with disturbed electrolyte and fluid equilibrium and hence the procedure is fraught with numerous hazards and complications. The authors believe that many of these hazards and complications can be overcome if certain fundamental principles are understood and carefully observed.

Peritoneal lavage, although established clinically as a means of treating acute renal failure with anuria and uremia, is not without certain hazards and complications, some of which may be serious. Because of this, and since, at best, it can lead only to temporary clinical improvement in patients with advanced organic renal disease, its use as a therapeutic measure should be restricted to those cases in which acute renal failure is associated with reversible renal lesions.

The risk of lethal peritonitis, although small, remains a factor with which to reckon. Peritoneal contamination appears to occur in a large percentage of cases, whether or not a bacterial filter is used in the system. Whether or not the use of improved peritoneal tubes will reduce the incidence of peritoneal infection remains to be seen. There can be no doubt that the antibiotic agents penicillin and streptomycin, added to the irrigation fluid and administered parenterally, are of the utmost importance in control of this complication.

Difficulties in the maintenance of adequate electrolyte and water balance on both sides of the dialyzing membrane constitute the greatest hazards. It has been shown repeatedly that this balance is extremely delicate, and minor changes of the technique, the composition of the fluid, or of parenteral therapy may produce rapid and in some cases deleterious consequences The. complications of severe dehydration, electrolyte depletion, and overhydration with massive peripheral or pulmonary edema are of such magnitude that they cannot be underestimated.

Channeling and pocketing of the omentum and intestinal coils about either the inflow or the outflow tube, with disruption of the flow of peritoneal fluid and reduction of the dialyzing surface, constitute a further complication to the procedure. Perhaps the reduction of the incidence of peritoneal contamination and infection and the addition of heparin to the irrigating fluid in increased amounts will, to a great degree, aid in combating this hazard. There is no doubt that intra-abdominal adhesions resulting from previous abdominal operations will aggravate and tend to promote a disastrous development of this kind.

Yet, if the foregoing possibilities are borne constantly in mind, the results achieved often justify the risks involved. The procedure itself is basically simple, and the apparatus can be constructed and assembled in any hospital. Facilities for preparing sterile perfusion fluid in large amounts must be available, as well as an adequate clinical laboratory for analysis of the blood counts, chemical examination of the blood, and the other indicated studies. Beyond this is needed an interested clinician, informed as to the basic physiology of the peritoneum as a dialyzing membrane and as to the water and electrolyte requirements of the patient, and with mind and eye alert for the development of complications.

It is the opinion of the authors that when acute suppression of renal function with increasing renal insufficiency develops, several days of routine intravenous therapy and supportive measures should first be employed in an attempt to promote the formation of urine. If at the end of this time conservative measures have failed and it appears that fatal termination of the case may result, the procedure of peritoneal lavage should be initiated as a lifesaving measure. A discussion of procedures and the data pertaining to 6 cases is included.

The Rapid Injection of a Solution of Amino Acids. RICHARD D. ECKHARDT AND CHARLES S. DAVIDSON. *N. England J. M.*, 1948, 239: 164.

A 10 per cent solution of amino acids prepared by the complete acid hydrolysis of casein, devoid of peptides, largely freed of glutamic and aspartic acids, and supplemented with dl-tryptophane and glycine, was administered 342 times to 62 subjects at the Thorndike Memorial Laboratory, Boston City Hospital, Boston.

Over 70 per cent of all infusions were administered at rates usually unattainable with the previously available protein hydrolysates (50 gm. of amino acids in 70-kgm. subjects in less than an hour). All injections supplied at least 0.5 gm. of protein per kilogram of body weight, and many of them were larger.

The clinical tolerance of the solution of amino acids was evaluated in normal subjects as well as in patients with a variety of illnesses requiring parenteral protein therapy. However, there was no apparent difference in the clinical tolerance of the amino acid solution whether it was given with glucose, saline solution, lactate, or vitamins, or when it was given repeatedly.

The incidence of pyrogenic reactions was 0.3 per cent; nausea, 9.4 per cent; vomiting, 2.6 per cent; venous thrombosis, 2.3 per cent; and transient anorexia 9.1 per cent.

Because of the rapid rates of infusion attainable with but few untoward reactions, it was concluded that the solution of amino acids employed in this study was better tolerated in man than the protein hydrolysates previously used.

ROBERT MAYO TENERY, M.D.

Calcifying Epitheliomas of the Skin (Type Malherbe) KAI SETÄLÄ. *Ann. chir. gyn. fenn.*, 1948, 37: Supp. 3.

The author examined 29 cases of a new type of tumor. These calcifying epitheliomas were located in the subcutis and seemed to lack even a slight epithelial connection with the overlying dermis. The tumor itself was composed of numerous epithelial cell masses or bands, each of these being separately surrounded by a single layered mantle composed of cuboidal or cylindrical epithelial cells. The medullary portion was formed of squamous-celled elements, which possessed a particular tendency to retrogressive alterations. The tumor was surrounded by a connective tissue capsule which often showed a well developed network of capillaries. The tendency of the epithelial portion to form tissue of a lower vitality was no doubt the essential factor influencing the microscopical picture of the calcifying epitheliomas. From the surrounding capsule-like formation, newly formed invading connective tissue grew and replaced the changing epithelium. This connective tissue had either undergone hyaline degeneration and later become calcified, or had actually begun to ossify.

The author expresses the opinion that the calcifying epitheliomas might be derived from hair follicles. The microscopical examination revealed in 3 cases signs which justify the statement that the tumor may be only "locally" malignant. In none of the cases had the infiltrative destructive growth progressed far enough to destroy the surroundings to any extent.

JAMES WEAVER, M.D.

Hemangiomas of Striated Muscle. C. FRED GOERINGER. *Am. J. Surg.*, 1948, 76: 58.

The author reports 3 cases of hemangioma of striated muscle. The first was that of a Chinese, 22 years old, who had a 1 year history of swelling of the lower inner aspect of the right thigh. A cavernous hemangioma of the sartorius muscle was found and excised. Only one other case has been described in which the tumor was confined entirely to that structure. Case 2 was that of a 19 year old white female, complaining of pain in the left calf and inability to dorsiflex the left foot of 2 years' duration. A cavernous hemangioma of the calf muscles was found and removed. Case 3 was that of a 15 year old school girl, who complained of a swelling of the inner aspect of the left elbow noted 5 years previously. At operation the tumor was found to consist of dilated veins in the substance of the flexor sublimis digitorum muscle. The upper 2 inches of the muscle was removed, and the lesion proved to be a cavernous hemangioma.

Almost half of the patients whose cases were recorded in the literature displayed symptoms before the age of 11 years. It is a disease that usually occurs in the first three decades. The incidence of hemangiomas is approximately equal in males and females. These tumors are predominantly congenital in origin. The lesion presumably arises in the vascular plexus of the muscle or in the peri-

mysium between the muscle fibers. The most commonly accepted classification includes the cavernous, capillary, venous, and arterial types. The cavernous variety is by far the most common. The treatment of choice is complete surgical excision. Except in unusual cases in which the hemangioma is extremely large, excision can be accomplished in one stage. The mortality from operative treatment should be low and the incidence of recurrence negligible.

LeRoy J. Kleinsasser, M.D.

EXPERIMENTAL SURGERY

The Reconstruction of Natural Ducts with Bird Quills (La reconstrucción de conductos naturales sobre cálamos de ave). Federico E. Christmann and Hector U. Defeo. *Rev. espan. cir.*, 1947, 7: 1.

Because of the variation of sizes, the abundance of supply, and the ease of sterilization, the quills of bird feathers are employed in the reconstruction of some of the natural ducts found in the human body. After considerable animal experimentation in which the quills were placed in the gall bladder ducts and ureters, the procedure was applied to man. The results were equally as good as in the experimental animals. Added advantage is obtained because of the variable caliber of the quills, which permits exact adaptation to the size of the duct, and the remarkable tolerance of body fluids to their presence.

The first human application was made in a patient having a postoperative stricture of the common duct. A perfect tunnel was obtained and the stricture was relieved by means of the insertion of a quill bridge. The icterus, pain, and fever left almost immediately. The second case, one of choledochal stricture, was instantly relieved by catheterization of the duct with a quill.

Eight ureterosigmoid transplantations were done by a similar technique with the Witzel-Coffey procedure. The results were most encouraging, and the outstanding feature was the remarkable tolerance of the body to the quill. There was practically no reaction either on the part of the tissue or the substance flowing through the tube.

Several cases of vascular repair have likewise been done, and the authors compare the quills to vitallium in their usefulness and inert reaction.

Stephen A. Zieman, M.D.

A Resin Artificial Kidney. E. E. Muirhead and Allen F. Reid. *J. Lab. Clin. M.*, 1948, 33: 841.

These investigators have devised a simple artificial kidney comprised of 20 mesh screen impregnated with a cation exchange resin (amberlite) and an anion exchange resin (deacidite). The apparatus is enclosed in a glass tube with a water control jacket and washed with distilled water until clean. The bed is thoroughly conditioned with a heparinized solution. The resin bed is then filled with a blood substitute; the femoral artery of a bilaterally nephrectomized and heparinized dog is cannulated and attached to one end of the apparatus via an interposed manometer. The blood is perfused through the resin mesh by gravity for a period of 10 minutes, being passed back into the dog's circulation by cannulation of the opposite femoral vein at a rate of 70 cc. per minute. Six dogs were subjected to perfusion in this manner.

The resin bed is washed free of its adsorbed waste products, and in one dog which was kept alive for 6.5 days after nephrectomy a total of 3.5 gm. of urea were removed. No reaction or hemolysis was noted.

More comprehensive in vitro experiments demonstrate the possibilities of *p*H adjustment, maintenance of osmolar concentration, adjustment of ionic disturbances, and the removal of waste products with the resin artificial kidney.

The resins chosen, however, did not prove adequate to remove all nitrogenous wastes. Moreover, the deacidite has been noted to cause toxic reactions manifested in the dog by restlessness, jerks, and tachypnea.

The problem of extracting a large part of the waste products in the residual pool of blood remaining in the device at the end of the perfusion operation also has not been solved by this type of artificial kidney.

The adaptation of this device to clinical use is not yet indicated.

Jane C. MacMillan, M.D.